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MAKING THE PHILIPS PRESSED STEEL PULLEY

OUT-OF-THE-ORDINARY SHEET-METAL FORMING OPERATIONS USED IN STEEL PULLEY MANUFACTURE

BY CHESTER L. LUCAS*

THE advance that has been made in producing good pressed steel pulleys has been largely responsible for their popularity. The earlier types were crude, but the modern pulley is light, strong and has excellent gripping qualities. Through the courtesy of Mr. J. J. Monday, president of the Philips Pressed Steel Pulley Works, Philadelphia, Pa., we are enabled to present the principal steps in the making of a modern pressed steel pulley. There are several types of steel pulleys but the Philips pulley is the only one in which the cross-section of the entire rim and supporting flange is made from a single sheet of metal. This pulley is illustrated in Fig. 1 and the steps in the formation of the rim and flange are indicated in the line illustration Fig. 2. From this it will be seen that the rim is one continuous surface of metal, properly crowned and integral with the inner part of the flange which is attached to the spider. This point should be firmly borne in mind throughout the article, as the manufacture of a pulley of this character presents unusual difficulties on account of this feature.

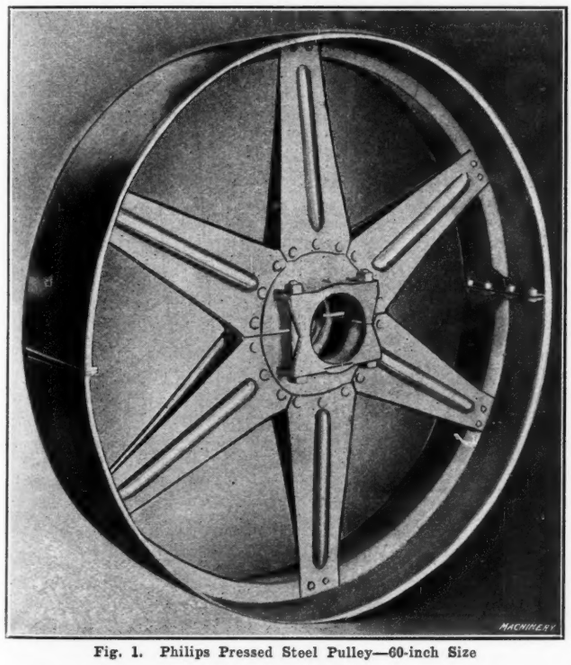

Fig. 1. Philips Pressed Steel Pulley—60-inch Size

These pulleys are made in diameters ranging from 12 inches to 60 inches, and with faces from 2 inches to 16 inches wide. For these varying sizes, different thicknesses of stock are employed, the thinnest being 17 gage and the thickest 12 gage. The first step in making the rim, aside from the shearing of the strips of steel, is the notching of the four corners as shown at *A* in Fig. 3. The purpose of this notching is to clear the metal from the section where the right angle bend must be made at each end to provide flanges for joining the two halves of the rim. This notching is a simple punch press operation and needs no further description. Next, the edges of the sheet are folded at right angles, as shown at *B*, so that they may later become the section which may be seen projecting from the center of the rim at *D*, Fig. 3, forming means for attaching to the spider. Two operations are required in doing this, the results being indicated at *C* and *D*. The folding over of these edges, as well as the subsequent bending of the rim-strip to the forms shown at *C* and *D*, requires a special type of machine, for to be successful as a manufacturing proposition it is essential that a quick and easily performed method of bending be employed.

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Rolling the Rim Sections

For doing this work the rolling method has been found to be the most satisfactory, and Fig. 4 illustrates the details of

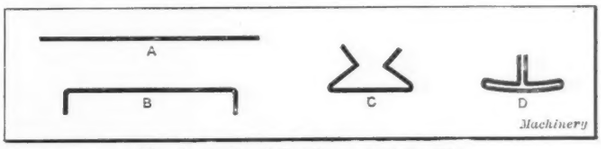

Fig. 2. Sectional Development of the Rim

the working parts of one of these machines. The principal parts of this type of machine are the long body *A* upon which a carriage *B* is traversed by a rack and pinion drive. The sheet of stock is laid upon this table and a plate *C* is clamped upon it by two clamps *D*. When locating the strip upon the table of the rolling machine, the edges overhang at each side just enough to make the two folded edges. Thus the blank is supported from above and below at the center section, leaving the edges unsupported so that they may be readily bent. As the clamping plate is a heavy casting to handle, a lifting toggle *J* is provided to assist in

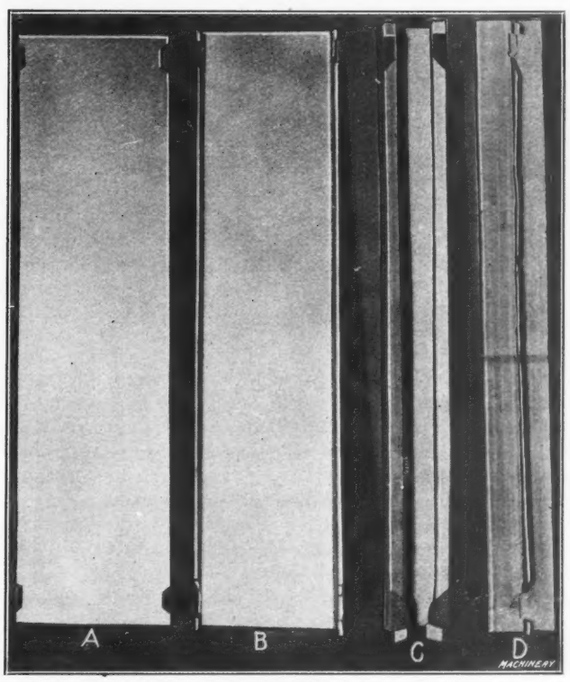

Fig. 3. The First Four Steps—accomplished in the Machines shown in Figs. 4 and 5

adjusting the strip before the rolling operation commences, and it also serves to return the plate after the strip has been removed at the end of the rolling stroke. While firmly clamped upon the table, the table, stock and plate traverse between the uprights *E*, the top of the clamping plate passing under the rolls *F*, which insures a continuous pressure

being placed downward upon the sheet. While this downward pressure is being applied the edges are passing by two cam-strips *G*, only one of which may be seen in Fig. 4. These cam-strips are so bent that the edge of the metal is gradually twisted from the horizontal plane down to the vertical plane by reason of its contact with the cam-strip. At the end it passes under a roller *H* which "sets" it against the edge of the carriage, leaving it in a perfectly square

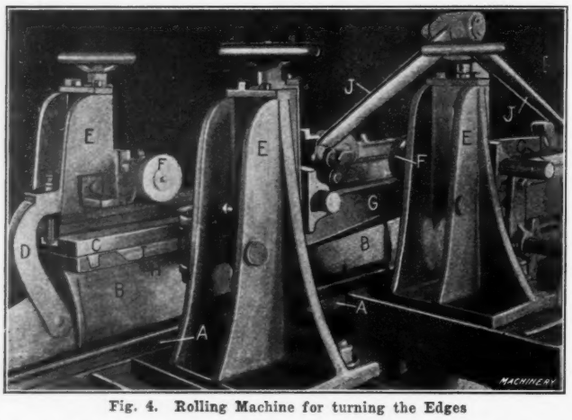

Fig. 4. Rolling Machine for turning the Edges

bent condition, as shown at *I*. This operation leaves the rim-strip in the condition shown at *B* in Fig. 3. Subsequent bending operations which bring the rim-strip into the condition shown at *C* and *D* in Fig. 3 are performed upon another machine. This machine is illustrated in Fig. 5 and it works upon the same principle as that previously described in bringing the strip from the state shown at *B* to that shown at *D*, Figs. 2 and 3. For this purpose the strip in the condition at *B* is placed upon the carriage *A* of the rolling machine illustrated in Fig. 5, and a plate *B* is clamped upon it.

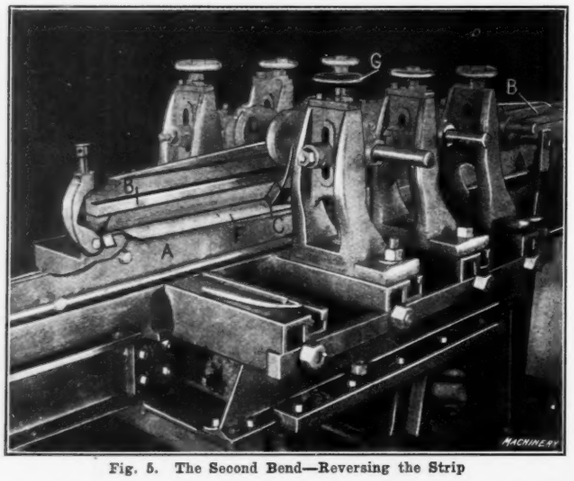

Fig. 5. The Second Bend—Reversing the Strip

It should be noted that in locating the strip, the turned edges are placed upward. As in the machine previously described there is a pair of cam-plates, one of which is shown at *C*, and as the carriage and clamping strip pass under rolls *D*, of which there are six, the edge of the strip comes in contact with the beginning of the cam-strips. At the start these strips simply bear on the top of the rim blank, and as the work follows the cam-piece down, it gradually takes on the finished shape, so that when it emerges at the end of the cam-strip, as shown at section *F*, that part of the work is completed. The cam-strips are adjustable, and the rolls which bear upon the clamping plate may be adjusted through hand screws *G*. The machine in Fig. 5 is used for rolling the strips to the condition shown at *C* in Figs. 2 and 3, and by inserting a new pair of cam-strips and holding block this piece is brought to the condition shown at *D*, Figs. 2 and 3, leaving it ready to be curved into the final rim shape.

Curving the Rim

One of the most important operations in the making of the Philips pulley is the curving of the rim-strips to form the two sections of the pulley. This operation presents difficulties in that it is very important that the central rib formed by the two edges of the strip be kept perfectly straight and free from buckling. This rolling is performed in the machine shown in Fig. 6 which at the same time crowns the rim face and leaves it curved properly for assembling. By referring to Fig. 7, the details of the working parts of this machine may be more clearly seen. The roll over which the strip is formed must, of course, be the exact diameter of the finished pulley. This means that sets of rolls must be provided for the different diameters of pulleys. As the pulleys are made in various widths of face as well as diameters it will be seen that the number of rolls required for rolling a complete line of pulleys would be very great

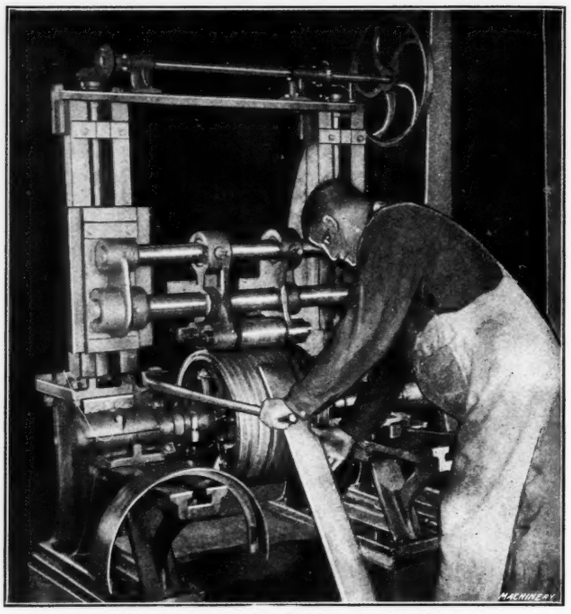

Fig. 6. Starting the Rim-forming Operation

were it not for the fact that each size of roll is arranged so that the various widths of pulleys may be formed upon it, although the upper rolls which support the face of the rim-strip must be changed to suit every width of face. Before the straight rim-strips come to this machine, iron stiffening rods are slid into the outer edges of the bends so that they may be rolled in place and thus reinforce the edges of the rim. To accommodate the various widths of pulley faces, the forming rolls over which the strips are curved are cut

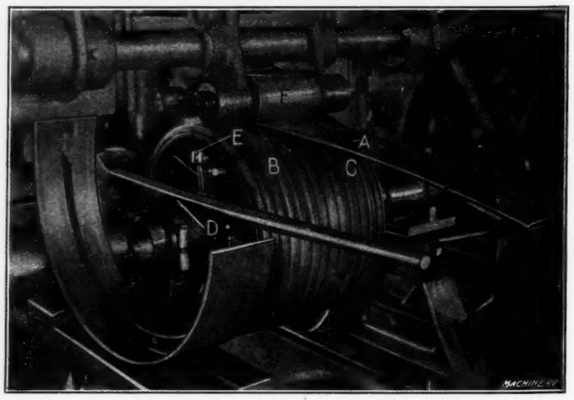

Fig. 7. Details of the Rim-forming Operation

with depressions corresponding with each width of pulley face which that diameter of roll will be called upon to form. These depressions are to allow the reinforced edges of the rim to drop beneath the surface while being rolled. One of the completely rolled strips is shown at the left-hand side of the machine in Fig. 7, and from this it will be seen that the central rim is preserved very straight and smooth, being in fact, in better condition than it was in the straight form.

This is accomplished by having the lower forming roll in two sections *B* and *C*, of which *C* is stationary and *B* capable of being set up against *C* by means of lever *D* and toggles *E*. It has already been stated that the object of cutting out notches at the corners of the sheet shown at *A* in Fig. 3 was to provide clearance for the right-angle bending of the end to secure flanges for bolting the two halves of the rim

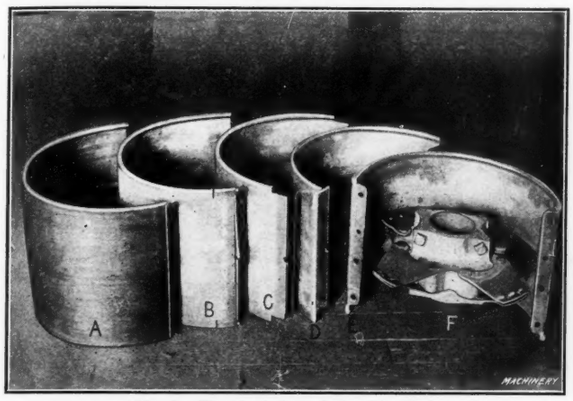

Fig. 8. The Evolution of the Rim Lug

together. The purpose of the short section of tongue remaining beyond the notch was not stated, however, and the object of this is to secure a gripping surface for starting the rolling operation. As shown in Fig. 6, the operator starts the piece by separating the two halves *B* and *C* of the roll and inserting the extreme end of the tongue in the gripping section of the rolls where the inner faces are knurled. Clamping the knurled section against the tongue he starts the rolling operation, allowing the strip to feed in under the pressure rolls *F* which press the strip into shape against the forming rolls *B* and *C*, at the same time squeezing the flanges down between the rolls. After running under the pressure rolls for two revolutions the piece is formed and ready to be taken from the machine. The point that should not be overlooked in this rolling operation is that the central rib or flange is kept from buckling by reason of the side pressure exerted between halves *B* and *C* of the forming rolls, so that when the upper rolls *F* force this web between the two halves it is confined so that it cannot buckle or distort in any way.

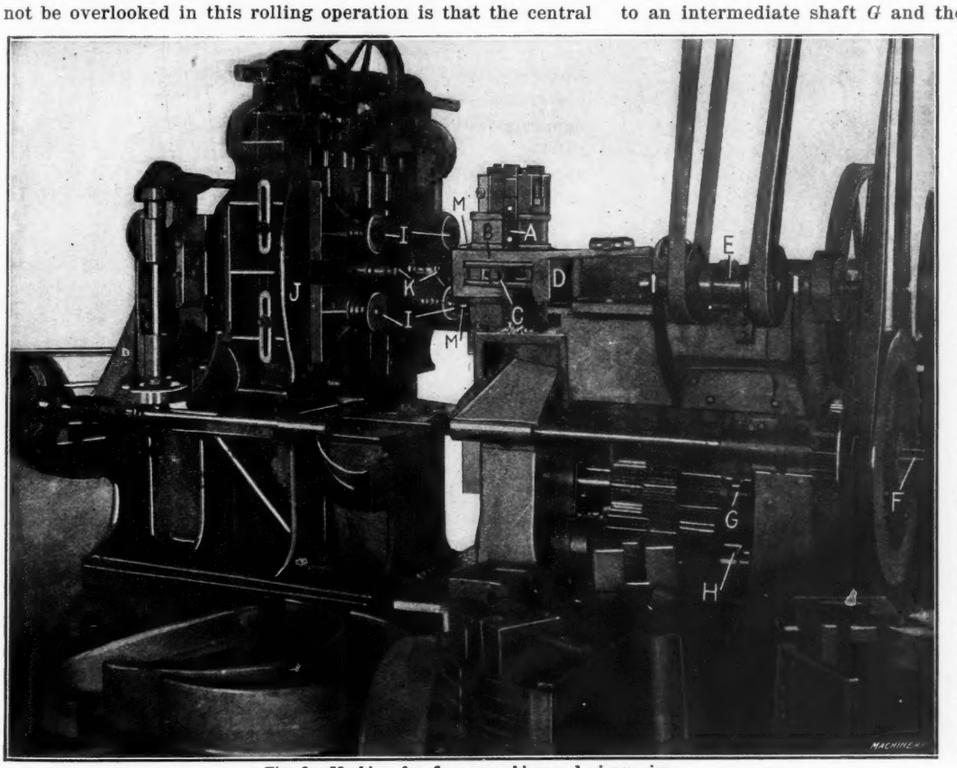

Fig. 9. Machine for flange-punching and rim-sawing

Operations on the Rolled Rim-strip

The operations performed on the rolled rim-strip are four in number and the rim-strip and the four operations are shown at *A*, *B*, *C*, *D* and *E* in Fig. 8. The first of these operations consists of sawing the edges of the rim, thus sizing them to the semicircular dimension, and at the same time punching the holes in the flange to provide for the riveting of the spider in place. The function of these rivet holes is more clearly illustrated by observing the spider shown at *F* in connection with the rib or flange of rim *E*.

This combined shearing and sawing machine is interesting in its operation, and is shown as a whole in Fig. 9. Referring to this illustration the machine may properly be said to consist of two working members on opposite sides of a stationary arbor *A*. The rim is placed upon this arbor as

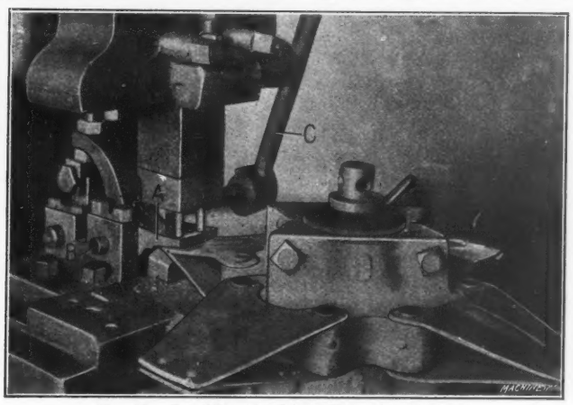

Fig. 10. Punching the Rivet Holes in the Arms

indicated at *B* and is firmly clamped in position by clamping strap *C* which is semicircular in form and held against the rim face, pressing it to the arbor by means of a traveling carriage *D*, which is advanced by power from driving shaft *E*. Through another driving shaft *F* at this end of the machine power is transmitted by means of a small pinion to an intermediate shaft *G* and thence to a pinion sleeve *H*, rotating upon a shaft, on the end of which there is a large eccentric. Now, by referring to Fig. 11, which shows the arbor and part of the eccentric on a larger scale, the method of punching the holes in the rim flange may be followed. Here again we have the central arbor and the clamping strap shown at *C*, and lower down may be seen the intermediate shaft *G* and the pinion sleeve *H* on the eccentric shaft. It will be noticed that in the center of the form where the rim is held, is a deep depression *B*. This is for the reception of the central rib of the rim through which the holes must be punched. For the purpose of punching these holes, a pair of punches is located at *P*, and the dies are, of course, directly beneath, allowing the punchings to drop out through the recess *Q*. These punches are held in a slide *R* which is reciprocated by a lever *S*, pivoted at *T* near the top of the arbor. The opposite end of the pivoted lever is held in the vertical shaft *U* and reciprocated by the eccentric motion previously referred to in connection with

Fig. 9. Some of the punchings from the central ribs may be seen in this illustration and even more clearly in Fig. 12 where they have dropped out from the dies. In Fig. 12, however, the work is shown in place; therefore the punches and dies are concealed.

This feature of the machine takes care of the punching only, the sawing being performed at the opposite side of the arbor. Referring back to Fig. 9, the arrangement of the sawing mechanism is adequately shown. There are four sawing spindles *I*, each fitted with circular saws and rotating at correct cutting speeds for steel. These are all mounted upon the traveling head *J* which is advanced by a hand lever on the opposite side of the machine until stop *K* strikes against the work-arbor *A*. The feeding forward of the head brings the saws into the cutting position, but in order to take up any little differences in the saw locations or end play of the spindles, the saws are flexibly mounted. They are held in forward positions on the arbors by stiff spiral springs. The feeding forward of the head causes the sides of the saws to bear against gages *M* and any differences in position are taken up by the spring pressure. Gages *M* are, of course, set so that the sawing will be done at exactly opposite points on the rim. At this point the saws are above and below the edges of the pulley rim, and by throwing in the vertical feed the operator causes the two lower saws to come up and the two upper saws to feed down into the rim, sawing until the feed is automatically tripped. This, of course, takes place after the rims have been sawed to the required depth. Sawing rather than slotting is necessary for this operation on account of the heavy steel wire reinforcement which is within the rim on each edge. The result of this operation leaves the rim in the condition shown at *B* in Fig. 8. In operation, the rim is clamped around the arbor by running carriage *D* up to the arbor so as to bring clamping strip *C* into action. Shaft *F* is transmitting rotation continuously to auxiliary shaft *G*, and thus to the pinion sleeve *H* on the eccentric shaft. This sleeve rotates loosely upon the shaft except when keyed to it by a clutch that is controlled by lever *V* shown in Fig. 11. Throwing over this lever, therefore, causes the eccentric to operate the set of punches, pushing them downward through the rim flange. The smaller rim halves have four punched holes, while the larger ones have six holes. The rim punching is followed closely by the sawing operation on the same machine as has been described.

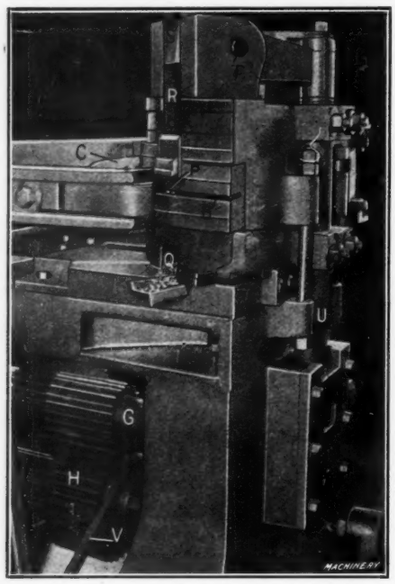

Fig. 11. Close View of the Arbor and Punches

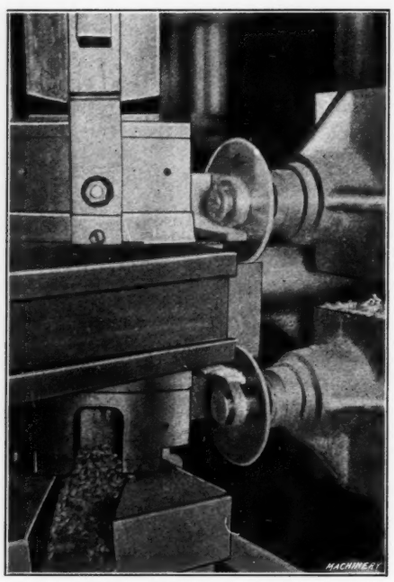

Fig. 12. The Sawing Operation

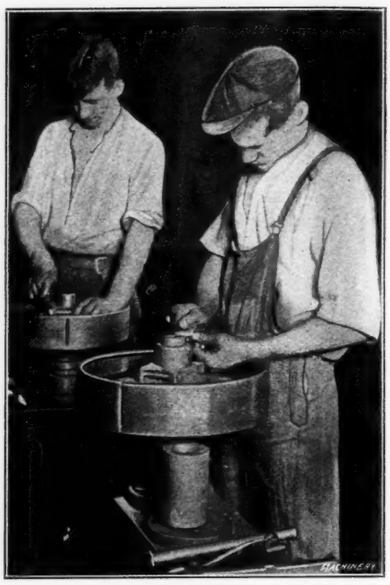

Fig. 13. Assembling the Pulleys

Preparing the Rim Halves for Joining

A series of three punching and forming operations follow the sawing and they are all done on similar machines, *viz.*, a type of horizontal punch. The first of these operations consists of cutting out the square section that has been sawed and rough-trimming the end of the rim section to approximately the finished length, leaving it in the condition shown at *C* in Fig. 8. The rough-trimming operation appears in Fig. 14. An adjustable table is provided upon which the rim is supported, its end being inserted between the punch and die of the horizontal punching machine. The work is located by means of the previously made saw cuts, and adjustable punches *A* and *B* cut out the two sections beyond the saw cuts, the punches being in line with the dies on the opposite side of the work. The object of having these punches and dies adjustable is to provide for trimming the different widths of rims which must be handled in the machine. Tongues on the punches fit into corresponding grooves in the punch-holder and make the changing over of the machine for another size of pulley a comparatively simple matter.

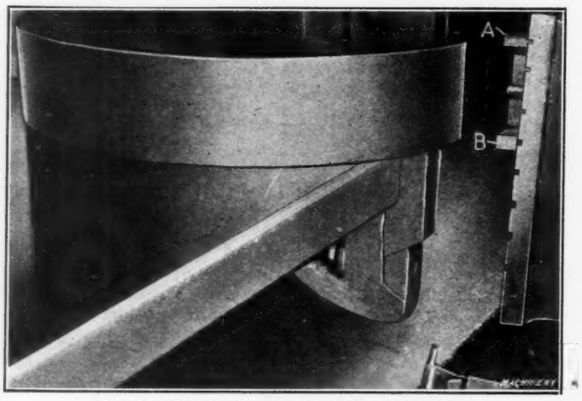

Fig. 14. Rough-trimming the Ends of the Rim

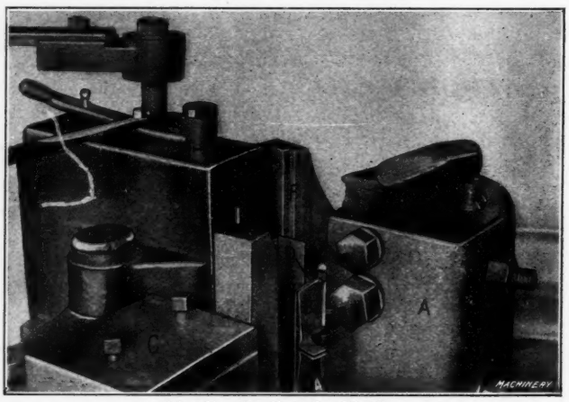

Fig. 15. Bending the Rim-lug

Following this operation comes the bending of the flanges to the condition shown at *D*, Fig. 8, on a machine similar to that illustrated in Fig. 15. While the machine on which this bending operation is done is similar to the horizontal punch, the movements of the tools are more interesting and may be best understood by the line illustration Fig. 16. In order to bend this end of the rim properly it must be supported while the right-angle bend is made, and then an additional "setting" bend from the front is necessary to give it the proper angle to make a good tight joint when bolted to the mating-rim half. Referring to the line engraving which shows a plan view of the working parts of the horizontal punch, the anvil is shown at *A* and the work encircling it at *B*. The ram or head of the punch appears at *C* and the side bending punch at *D*. After the work has been placed in position the operator swings hand lever *E* over, causing rocker arm *F* to bear against the work thus holding it firmly for the bending. Tripping the clutch of

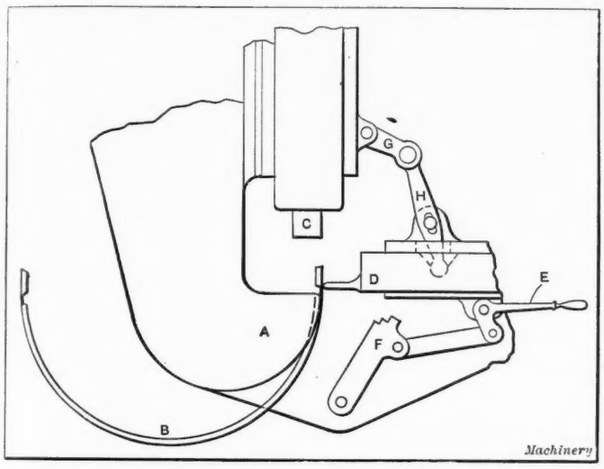

Fig. 16. The Mechanism of the Rim-lug Bending Machine

the punch the ram advances and through link *G* and toggle *H* the side bending slide *D* is caused to advance and make the first part of the bend, producing the approximate shape. As the ram continues to advance, the side bending slide draws back, after which the heading punch strikes the partly bent work and "sets" it against the form on the anvil. The operation of the cross bending slide by means of the heading punch is quite novel.

The third rim-finishing operation is along the same general lines, and comprises the final punching of the joining flange, trimming the lug to its finished shape and punching the

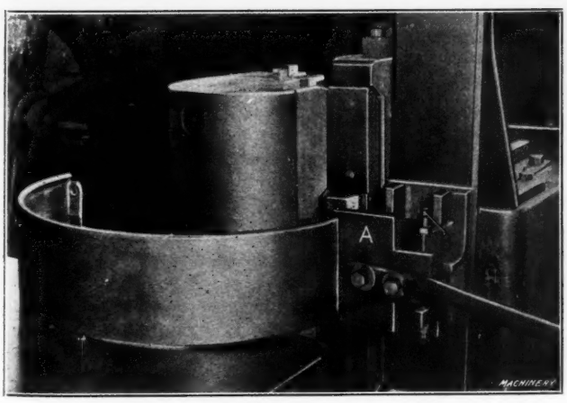

Fig. 17. The Final trimming of the Rim-lug

rivet holes for the attaching bolts. This operation is shown in Fig. 17, and with the exception of gate *A* which is hinged at *B* and serves to hold the work firmly while being punched this comparatively simple operation has no unusual features. This operation leaves the rim section in the finished condition shown at *E* in Fig. 8.

Making and Assembling the Spider

The spider or central structure from which the rim is supported is built up around a split cast-iron bushing. The two halves are bolted together and sheet metal arms riveted on each side to form connections with the central flange of the pulley rim. After these arms have been riveted in place, the ends are punched for assembling with the rim. It is very necessary that these rivet holes be equidistantly spaced from the hub of the spider so that the rim will be riveted

Fig. 18. Riveting the Arms to the Rim-flange

true with the bore in the hub, and thus produce a true running pulley. The punching fixture is shown in Fig. 10. This fixture has a pivot over which the spider may be slipped, and provision is made for indexing the spider for four or six arms, as the case may be. There is a certain amount of spring to the arms of the assembled spider, and in order to punch the holes accurately they must be held close together, while the punches are passing through the stock. For this purpose a stripper *A* is fitted over the die, being hinged at *B*, and extending out around the punches. Before punching,

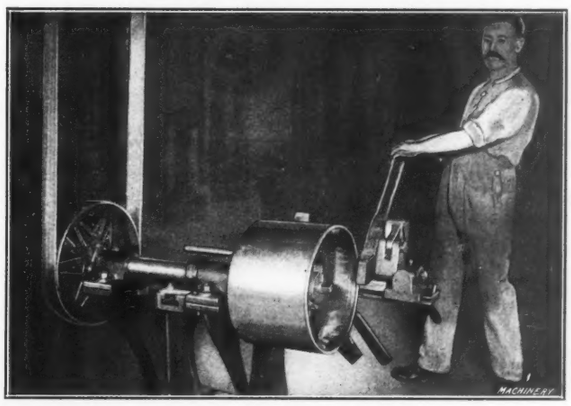

Fig. 19. Truing the Edge of the Pulley Rim

hand lever *C* is depressed, causing the stripper to be pressed against the stock, and while the two spiders are thus held close together, they are punched clean and accurate.

Two of the pulley assemblers are shown in Fig. 13. Their part of the work is to assemble the two halves of the rim about the spider and to insert the rivets ready for riveting. The spider is first mounted on a pivot stud and the two halves of the rim bolted over it. These operators handle S-wrenches continuously, and the speed which they develop in manipulating them while putting the bolts through the rim-lugs is remarkable, considering that the bolt locations are not very accessible.

In Fig. 18 may be seen one of the hydraulic riveters for upsetting the rivets when attaching the spiders to the rims. The riveter is fitted with a stationary anvil and a hydraulically operated punch directly over it. A traveling carriage is mounted on the frame of the machine, on which is supported a pivot stud which may be moved in or out according to the diameter of the pulley being riveted. The riveting operation is simplicity itself, for after the work is located, it is only

necessary to pull over the operating lever which hydraulically applies pressure to the riveting punch.

Truing the Pulleys

The final operation, exclusive of painting, on the Philips pressed steel pulley, is truing. This is an operation which requires considerable skill and no little manual strength. The pulley is mounted on the truing stand as shown in Fig. 19, and the operator revolves it by power and observes the way the rim runs, locating the high points by holding a piece of chalk stationary against the revolving rim. His first operation consists in throwing the edges of the rim into their respective vertical planes. This is done by pressing in the high points with a wooden lever applied as shown in Fig. 19. Two or three pulls by an experienced operator will usually put the edges into alignment. This part of the work being done, the face receives attention, and with the two

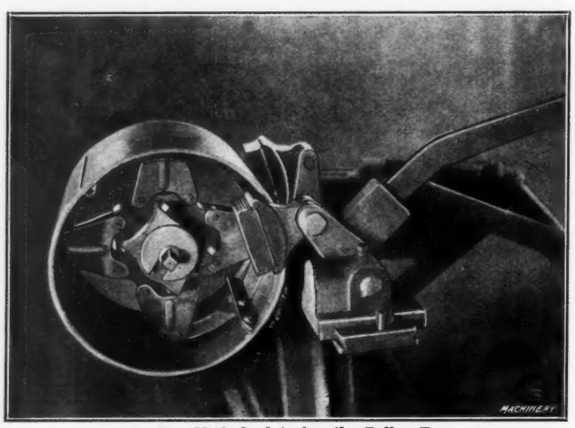

Fig. 20. Method of truing the Pulley Face

levers with which the truing stand is equipped, shown on a larger scale in Fig. 20, the rim may be trued. This is done by pressing down the high points by pulling up on the levers when their wooden faces are against the outside of the rim or by depressing the levers with the edge of the block caught inside the rim as shown by the forward lever in Fig. 20. It will be seen that four different combinations of the two levers may be secured; both inside, both outside, one inside and one outside in both directions, thus providing for restoring any distorted rim. Care has to be taken not to throw the edge out of true when working on the face and *vice versa*. In spite of the seeming difficulties of the pulley truing operation an experienced operator will true 200 finished pulleys in a day of 10 hours.

* * *

The cartoonists' idea of illustrating motor car troubles still seems to be to show the driver underneath, lying on his back or stomach, with his feet sticking out, working himself into a frenzy under the mysterious and diabolical mechanism. The cartoonists are not up to date. They have not found out, apparently, that very little of modern motor car machinery needs tinkering from beneath. It is true that the first cars were so built that the prostrate position of the luckless driver was necessary to effect many repairs, but the modern car is quite a different sort of machine. With the engine in front, the gear-box and clutch beneath the floor in front of the front seat, and the differential in the rear axle, there is very little indeed to call for taking a mud or dust bath underneath. But we suppose that comic pictures of automobile troubles will be shown in the conventional way for another ten years at least.

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Wireless telephony continues to make progress. Wireless communications have been established between Berlin and Vienna, a distance of 355 miles. A Japanese telephone official is credited with having invented a wireless telephone apparatus different from those used in Europe, which has been successfully tested between Yokohama and steamships 60 miles at sea.

DON'TS FOR DRILLING MACHINE OPERATORS*

BY JAMES E. COOLEY†

Don't use a loose feed belt.

Don't use the shank of a file for a drift.

Don't spot holes in the table with the drill.

Don't use a wrench or a file to throw off a belt.

Don't use a wrench or a collet to drive a drift with.

Don't forget to use oil when drilling malleable iron.

Don't drum on the table with the ball-end of a hammer.

Don't forget to fasten the spindle-head and table-slide.

Don't leave chips in the drilled hole; empty them out.

Don't try to drill tough steel with oil; use turpentine.

Don't run a twist drill in a cored hole; use a butt-mill.

Don't use a jack having a top as large or larger than its base.

Don't run a body-counterbore down too far in a tap size hole.

Don't use a reamed stud-hole in a knee to drill work through.

Don't put drills or reamers in collets having different tapers.

Don't let the lip of the drill strike on the edge of the bushing.

Don't let the drift and wrench get lost each time after using it.

Don't get in the habit of slapping a belt each time you adjust it.

Don't try to get along by using one jack; use two if necessary.

Don't leave the machine with a drill running idly in a bushing.

Don't slide a jig across the table and bang it against the drill.

Don't try to grind a reamer if it does not cut; take it to the foreman.

Don't forget the value of a long leverage as a stop when drilling.

Don't forget that a piece of hard wood is handy to drill sheet metal on.

Don't fail to clean and oil the threads in the clamp screws occasionally.

Don't have a foot on a jig extend over the edge of a hole in the table.

Don't be afraid to own up that you have broken a drill or counterbore.

Don't throw or toss drilled work in a box; lay it down carefully.

Don't be above sweeping the dirt around your machine into a neat pile.

Don't fail to lower the spindle-head as close to the work as possible.

Don't bear down too hard when drilling a hole through the rim of a pulley.

Don't forget to chalk over the spot you are laying out on a rough casting.

Don't think that it is necessary to sit down for every drilling operation.

Don't let oil drip off the table onto your overalls, shoes, or the floor.

Don't let the drill cut on the edge of the holes or slots in the table.

Don't fail to look and see if every hole has been drilled in the piece.

Don't drive a drill out of a sleeve collet by striking the end on the table.

Don't be too slow in putting in and taking out a quick-change drill collet.

Don't use your fist to drive a heavy casting under the drill; use a babbitt hammer.

Don't use machine oil to drill with; use lard oil or a drilling compound.

Don't forget to fasten every screw in the jig and lock the work in securely

Don't place the fingers under the work to feel if the drill is coming through.

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* For "Don'ts" previously published in MACHINERY, see "Don'ts for Drill Grinders," July, 1913, engineering edition, and "Don'ts" there referred to.

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Don't put a jack directly under the point where the drill comes through the work.

Don't put on the feed until the point of the drill is down against the work.

Don't forget to have another piece ready to put in the jig when one is taken out.

Don't kill time by letting the drill run deeper in the work than is necessary.

Don't use too much oil when tapping holes in cast iron with the tapping fixture.

Don't forget to take out the scratches and dents in the table with a smooth file.

Don't throw clamps and bolts around on the floor and jam the threads in the screws.

Don't drill aluminum without using kerosene oil; it makes a very smooth hole.

Don't forget that brass, aluminum and wood should be drilled at a high speed.

Don't forget to use the try-square against the spindle to see if the work is true.

Don't forget to spot a hole with a full-size drill, before using a tap size drill.

Don't use a center-punch made out of a round file; it is too brittle and dangerous.

Don't forget to fasten the tap securely in the tapping fixture before tapping a hole.

Don't keep the jacks where you have to stretch over to reach them; have them near you.

Don't fail to rub oil on the pilot of counterbores each time they are placed in a hole.

Don't use extension collets to lengthen the spindle unless absolutely necessary.

Don't use a large drill press to drill a small hole, when a smaller one can be used.

Don't start to drill a hole unless you are sure you are using the right size drill.

Don't let the spindle-sleeve get gummed up; wipe it clean and oil the entire length.

Don't forget to put a piece of sheet brass between the end of the clamp screw and the work.

Don't stand on the table or belt-shipper to adjust a belt while the machine is running.

Don't forget to clean off all taper shank tools before "socking" them up in the spindle hole.

Don't think a piece of work will hold itself while it is being drilled, but fasten it down.

Don't yank the belt-shipper forward to start the machine, but draw it over carefully.

Don't take a drill out of a spindle by clamping a monkey wrench across the flute and twisting it.

Don't forget to look at the outer end of the work that is being drilled to see if it tips up.

Don't push a drill down in a bushing without first oiling the drill or inside of the bushing.

Don't put the spanner wrench in your pocket or in a place where someone will have to hunt for it.

Don't strap work on the outside of a knee or angle plate when it can be placed on the inside.

Don't drive out an Almond chuck from the spindle by hitting it on the back end; use a drift.

Don't forget that a dull tap in a tapping fixture breaks the fixture quicker than the tap.

Don't forget that a reamer should be drawn up from a hole, nearly as slowly as it was run down.

Don't forget to wipe the oil and chips from the table each time before laying the jig down under the drill.

Don't forget that a box is a handy thing for holding a pulley to drill an oil-hole in it on an angle.

Don't run a head counterbore into cast iron scale, but gouge out the hole first with an old drill.

Don't brush chips toward the column, as they will get in on the ways of the table slide.

Don't set a screw too tight against the piece in the jig; it will spring the piece or spread the jig.

Don't push a tap against a hole when it is running in the reverse direction in the tapping fixture; raise it up first.

Don't forget when drilling pin holes to try a pin in the hole occasionally to see if it will drive.

Don't forget to try the reamer in a hole after the drill is ground to see if the drill cuts small enough.

Don't try to hold work with the hand while drilling because it is too much trouble to rise and get a wrench.

Don't leave drills and reamers lying around after you are through with them; return them to the tool-room.

Don't use waste to wipe the chips off the tap while it is running in the tapping fixture; use a stiff brush.

Don't waste time by running a nut too far on the thread of a bolt when bolting down work; use plenty of washers.

Don't hasten the spindle stoppage after the machine is shut off by trying to insert the drift in the spindle broach.

Don't, when the drill runs off the center of a scribed circle use a center-punch to draw it back; use a draw-chisel.

Don't forget that the very first rudiment in running a drilling machine is to have the work square with the spindle.

Don't force out a collet from the spindle by placing the drift through the broach in the collet and twisting it.

Don't put the spout of the oil can down in a jig-bushing while the drill is in motion; the end will be chewed off.

Don't drill a heavy casting on a sensitive drilling machine as the weight of it will spring the table out of true.

Don't leave an Almond chuck with a drill in it lying lengthwise on the table; it will roll off and break the drill.

Don't forget when drilling a deep hole in cast iron that a little oil rubbed on the drill will prevent it from squealing.

Don't use a collet for a stop by driving the taper end down in a hole in the table, but bolt down a knee for this purpose.

Don't forget that if a small drill is run down into the mark made with a center punch, it will guide a large drill central.

Don't let a tap strike the bottom of a hole when using a tapping fixture, but be sure to set the stop to limit the depth.

Don't drive out a stud from an angle plate when it is strapped down; the hammering is likely to break or spring the plate.

Don't lay anything on the table too near a jig; in case it gets caught and whirls around it will sweep everything in range.

Don't forget when fastening a clamp over the table to have the head of the screw point downward; it is then out of the way.

Don't tighten the table slide or spindle head by hitting on the wrench with a babbitt block or hammer; the hand pressure is sufficient.

Don't, when the jig has been raised or tipped up, put it down again and continue drilling, because chips are likely to be under it.

Don't forget that the bottom end of a hole is smaller than the top and a hole should always be reamed from the drilled side.

Don't twist a drill with a wrench when it gets stuck in a jig; squirt a little turpentine in the bushing and it will come out easily.

Don't fail to examine the point of the drill after it has had a fit of sputtering in the hole; it has struck hard sand and needs grinding.

Don't have washers, nuts or clamps, etc., scattered around you; keep them in a box or, better still, drive nails in a bench and hang them up.

Don't forget that if you drill a hole in a separate piece and then strap it down over the piece you want to drill, you will get a true hole.

Don't leave the machine while it is running and think it will take care of itself; something is likely to get stuck and it is best to shut it off.

Don't fail to listen for the noise made by the drill when it is coming through the work, as it requires less pressure if there is backlash in the spindle.

Don't try to tighten up the drill chuck while it is running with the hand. When the drill slips stop the machine and use the spanner wrench.

Don't under any circumstances draw up a drill from a jig too quickly, as it will bind in the bushing and whirl the jig around.

DRAWING AND FORMING AN AUTOMOBILE CLUTCH CONE*

A GOOD EXAMPLE OF HEAVY SHEET-METAL FORMING IN THE PUNCH PRESS

BY DOUGLAS T. HAMILTON†

The automobile clutch cone shown in Fig. 1 illustrates one of the many interesting examples of sheet-metal work turned out by the Acklin Stamping Co., 1645-1653 Dorr St., Toledo, Ohio. This clutch cone is made from ⅛ inch cold-rolled sheet steel and is completed in the punch press, with the exception of a light cut taken from the bearing of the cone in

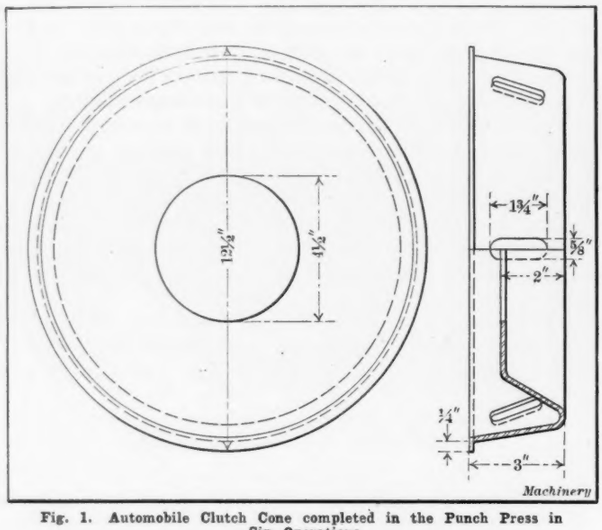


Fig. 1. Automobile Clutch Cone completed in the Punch Press in Six Operations

a grinding machine. The grinding is done in order to obtain a perfect frictional bearing surface. Some of the most important punch press operations on this clutch cone are illustrated in Fig. 2, where the nature of the work accomplished is evident. The cone is completed in the punch press in six operations, the completed part being shown at *D*.

Blanking and Drawing the Clutch Cone

In the half-tone Fig. 3 is shown the first drawing die and the result of the operation performed by it, the latter being indicated at *B* in the illustration. The blank *A*, which is 17

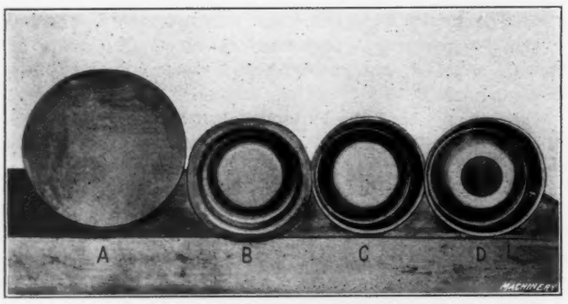


Fig. 2. Sequence of Important Operations performed on the Automobile Clutch Cone shown in Fig. 1

inches diameter by ⅛ inch thick, is cut out by a simple blanking die. Punch *H* is fastened to the base *I*, which is attached in the usual way to the bolster of a No. 78½ Bliss press shown in Fig. 4; draw ring *C* moves freely around punch *H*. The holder *D*, carrying the inserted die ring *E* and reversing pad *F* is held to the ram of the press. These dies are used in a single-action press and are given the double-action movement by means of a rubber compression pad under the bolster which operates the draw ring *C* through the medium of the six pins *G*. The pressure exerted by the rubber pad prevents the blank from buckling when being

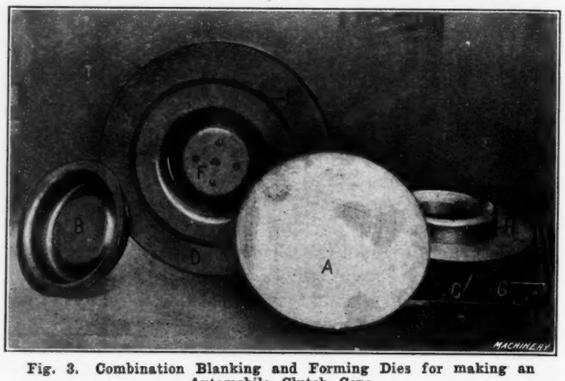


Fig. 3. Combination Blanking and Forming Dies for making an Automobile Clutch Cone

drawn. The reversing and drawing of the cup is accomplished by the punch *H* in combination with the reversing pad *F*. The result of this operation is shown at *B* in Figs. 2 and 3.

Redrawing and Tapering Dies

The dies used for redrawing the cup and bringing it to practically its final shape are shown in Fig. 5. These are held in the same manner as those shown in Fig. 3 and are

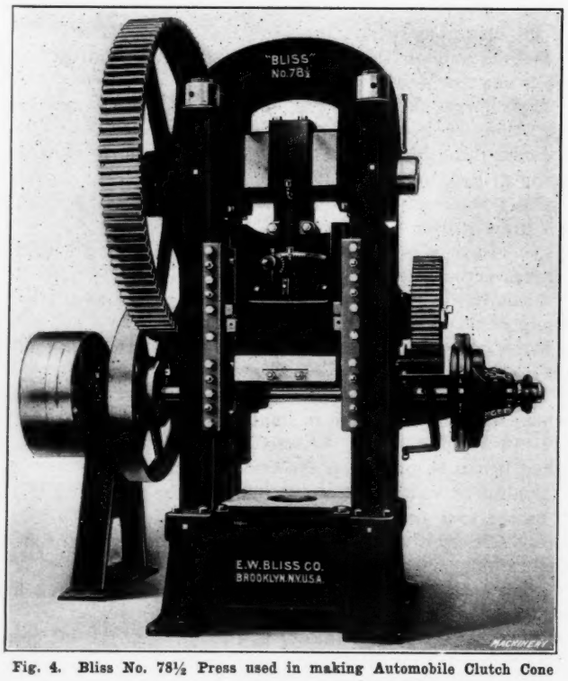


Fig. 4. Bliss No. 78½ Press used in making Automobile Clutch Cone

somewhat similar in design, with the exception that the exterior drawing surface of the punch *C* is tapered instead of straight like the punch used for the previous operation. These dies are also held in a single-action No. 78½ Bliss press. The pins *D* operate on the drawing ring *E* and prevent the blank from buckling when being drawn down into the die *F* by punch *C*. The condition of the cup before and after this operation is shown at *A* and *B* in the illustration, and at *B* and *C* in Fig. 2. The finishing operation requires a

* For additional information on punch and die work, see the following articles previously published in MACHINERY: "Blanking, Forming and Cutting Die," September, 1913; "Sectional Punch and Die Construction," July, 1913; "Blanking and Drawing a Large Steel Cup in One Operation," "A Problem in Press Work," July, 1913; "Blanking, Forming and Piercing Die," June, 1913; "Combination Punching, Cutting and Forming Die," "Punch and Die for Forming Electric Terminals," May, 1913; "Punch and Die made in Sections," "Punch and Die for Bending past the Vertical Line," March, 1913; "Standards in Die Work," "Locating Punches in Tandem Dies," "Tools for Multiple Plunger Presses, (engineering edition), February, 1913; "Some Interesting Drawing and Curling Dies," "A Bending Die," January, 1913; "Modern Methods of a Press Working Plant" (engineering edition), December, 1912; "Producing Drawn Steel Rollers in a Gang Die," "Drawing a Small Shell from Thick Brass," "Punch and Die for Forming Electric Terminals," "Combination Folding and Curling Die," November, 1912; "Method of Making Watch Case Pendants" (engineering edition), October, 1912; "Prevention of Wrinkles in Drawn Work," "Closing and Curling Die," September, 1912; "Tools for Perforating Lamp Burner Parts," "Watch Case Manufacture—," "Sub-press Die for Making a Cleat," August, 1912; "The Drawing of an Odd Shaped Cup," "A Piercing and Cutting Off Punch and Die," April, 1912; "Drawing a Flange and Tapered Cylindrical Shell," March, 1912; and other articles there referred to.

† Associate Editor of MACHINERY.

pressure of approximately 500 tons. After the redrawing and tapering operation the flange is trimmed and finished to size. Following this, the center hole is cut out.

Cutting the Elongated Slots in the Rim

Undoubtedly the most interesting operation in connection with the manufacture of this clutch cone is the cutting of the elongated slots in the rim. From an inspection of Fig. 1, it will be seen that the cutting of these slots presents a difficult problem, owing to the "returned" shape of the lower portion of the cone. This not only makes it hard to get at, but also makes it a difficult matter to get rid of the scrap if the punches are presented from the sides. The gang method of punching would be impossible owing to the slender construction of the dies which would be required for the space allowed. The tools used to accomplish this interesting operation are shown in Figs. 6, 7 and 8. Fig. 6 shows the work in position in the slotting die, while Fig. 7 shows the work removed and the die opened up and thrown back.

The manner in which this slotting die is used is as follows: The base *A*, Fig. 8, is held in the usual manner to the bolster of the punch press, while the two studs *B* are held by nuts

Fig. 5. Redrawing and Finish-forming Dies for Automobile Clutch Cone

in lugs cast integral with the ram of the press, and are used to return the punch-block *C* after the punch *E*, Fig. 7, has passed through the work. This, of course, is accomplished on the return stroke of the ram. The cutting die *D*, as shown in Fig. 7, is inserted in the base *A*, whereas the punch *E* is held in the block *C*, which is acted upon to punch the slot by a punch-holder *F*, held in the ram of the press.

In operation, the clutch cone is clamped to the circular holder *G* which is attached to the arm *H* by a block *I*, acted upon by a cap-screw *J*. This circular holder is revolved by hand and carries an indexing plate *K*, as shown in Fig. 8. This index plate is made of steel and is located for the different indexings by a hardened tool-steel dog controlled by the handle *L*. At the beginning of each indexing the moving

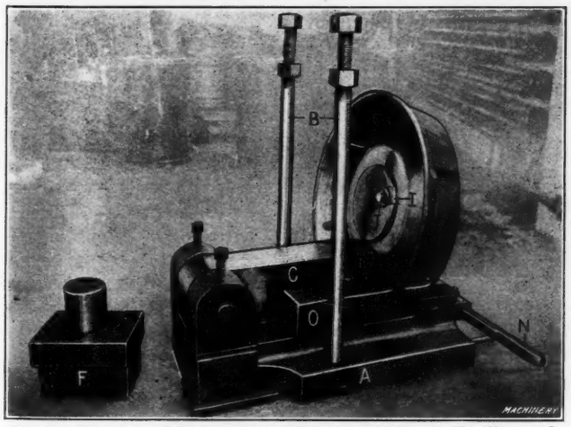


Fig. 6. Fixture used in the Punch Press for cutting the Six Elongated Slots in the Rim of the Clutch Cone

parts are securely clamped by means of the wedge *M* operated by handle *N* and the adjustable blocks *O* against which the rim of the cone is held. While these three members are not essential parts of the apparatus, they serve to render the gaging much more accurate. Handle *P* is attached to these blocks and is located in a recess provided in the base of the die shoe.

The ingenuity displayed in the solving of this difficult slotting problem speaks well for the ability of the Acklin Stamping Co. to handle sheet-metal stampings of unusual and complicated shapes.

* * *

FOOL-PROOF AUTOMOBILES

Some time ago a local paper published an item stating that a Norwich, N. Y., man drove his automobile ten miles with the emergency brake set, and humorously added, "It is

Fig. 7. Fixture shown in Fig. 6 with Work removed and opened up to show Construction

a pretty good car yet." This and other accidents that often happen indicate the need of better control apparatus on motor cars. Gears are often stripped by putting on the emergency brake with the clutch engaged, and other interferences contribute not a little to the rapid deterioration of the motive mechanism and tires.

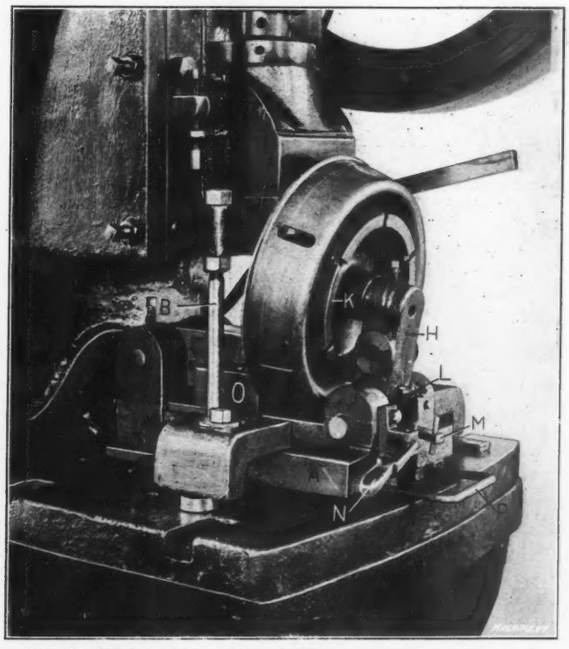


Fig. 8. Slotting Fixture shown in Fig. 6 set up in a Punch Press ready for Action

Automobiles, motor trucks and other power-driven vehicles should be provided with strictly interlocking gears which would prevent interferences of this character, and until that sort of control apparatus is achieved the motor car will not be a strictly practicable vehicle for all sorts of users. The tendency in all modern design is to simplify and make operation easy. Such improvements popularize machinery and materially reduce the cost of operation, to say nothing of making it safer for the average user. Safety is a prime requirement for all automobile driving, but so long as the driver can make serious blunders while driving they will continue to be made.

EXAMPLES OF SCREW MACHINE "SET-UPS"*

VARIOUS "SET-UPS" USED IN MAKING PARTS ON THE "ACME" MULTIPLE-SPINDLE AUTOMATIC SCREW MACHINE

BY DOUGLAS T. HAMILTON†

As one of the first considerations in laying out a job on the Acme multiple-spindle screw machine is to determine the best method of applying the tools, etc., a few examples of representative "set-ups" will be given. Of course many jobs could be handled in several different ways; but as a rule there is

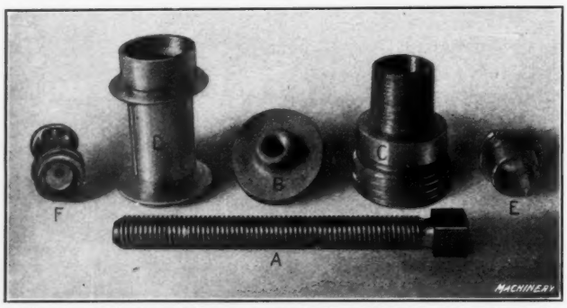


Fig. 1. Collection of Pieces economically produced on the "Acme" Multiple-spindle Automatic Screw Machine

always some governing feature that makes it possible to produce the part much more quickly and accurately in some specific way. Fig. 1 shows a number of parts produced on the "Acme" automatic by methods which are commendable, and in the following a description will be given of the tool equipments and "set-ups" used. The examples shown in Fig. 1 have been chosen because they represent several of the most common tooling methods employed in producing the general run of work.

"Set-up" in which the Longest Operation is performed from the End-working Tool-slide

The long set-screw shown at *A* in Fig. 1, and also in Figs. 2 and 4, is a common piece of work produced on the "Acme"

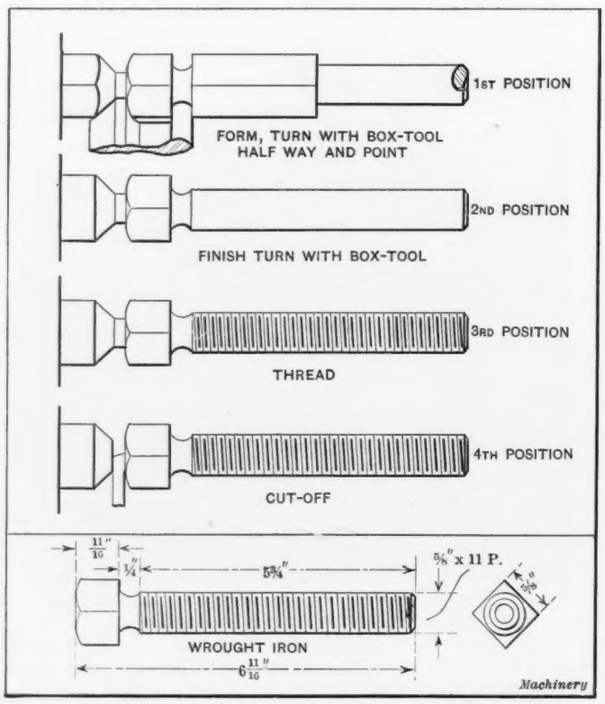
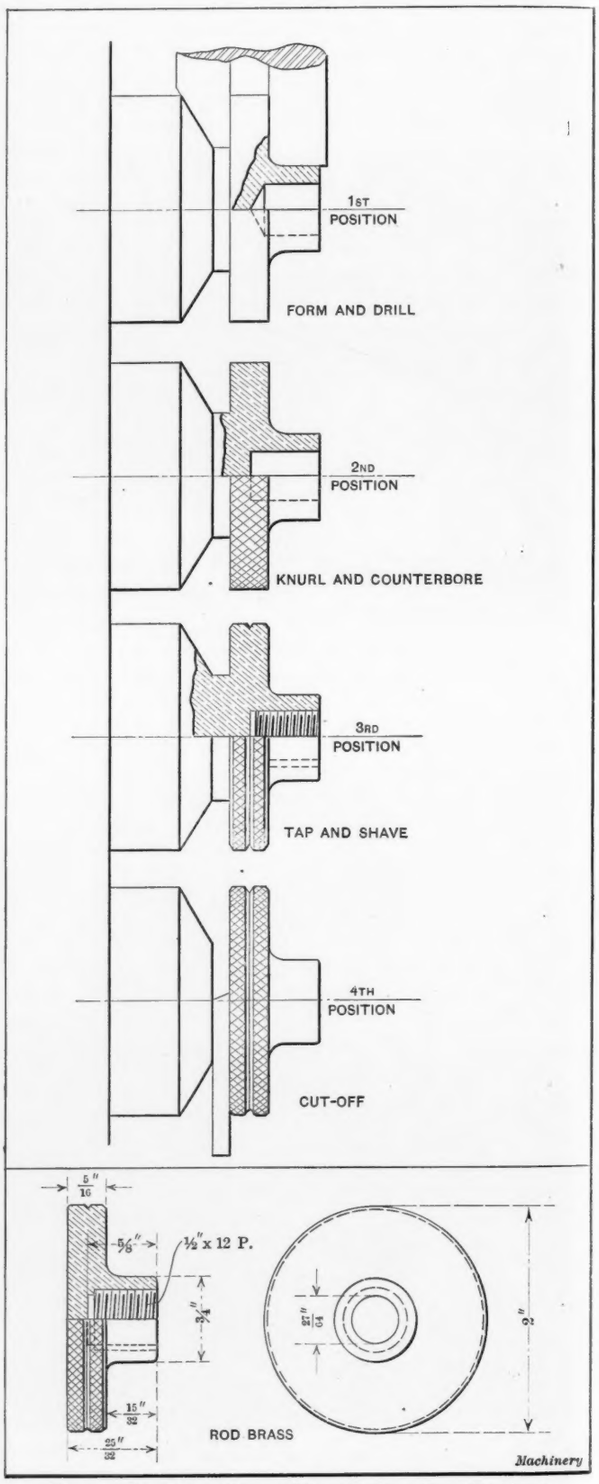


Fig. 2. Order of Operations used in making a Long Square-headed Set-screw

multiple-spindle automatic. By referring to the lower section of Fig. 2, it will be seen that this set-screw is made from a square wrought-iron bar, and that the threaded portion is 5¾ inches long, the length over all being 6 11/16 inches. The longest single operation, as can be seen at a glance, consists in turning down the body diameter to the required size. We first decide on the machine to use for this piece, endeavoring where possible to use the size of machine that will handle



* Fig. 3. Order of Operations used in producing a Brass Thumb-nut

the work most economically. Of course where only a few sizes are in use it is not always possible to select the machine best suited to every job. It is advisable, however, to have the work approach, as closely as possible, the rated capacity of the machine that is to produce it.

The distance across the corners of this set-screw is 0.880

* For material previously published on the "Acme" multiple-spindle screw machine, see "Setting Up and Operating Screw Machines" and articles there referred to in the October, 1913, number of MACHINERY.

†Associate Editor of MACHINERY.

inch, so we will select a No. 53 machine—this being the nearest size. The next step is to determine the spindle speed at which to rotate the work. Taking the diameter of the stock across the flats as the basis of our calculations and deciding on a surface speed of 100 feet per minute, we find that the desired spindle speed would be 611 R.P.M. Upon referring to Table VIII in the January, 1913, number of MACHINERY, we find that the nearest spindle speed is 635 R.P.M.; this gives a surface speed of about 104 surface feet per minute, which will not be too high.

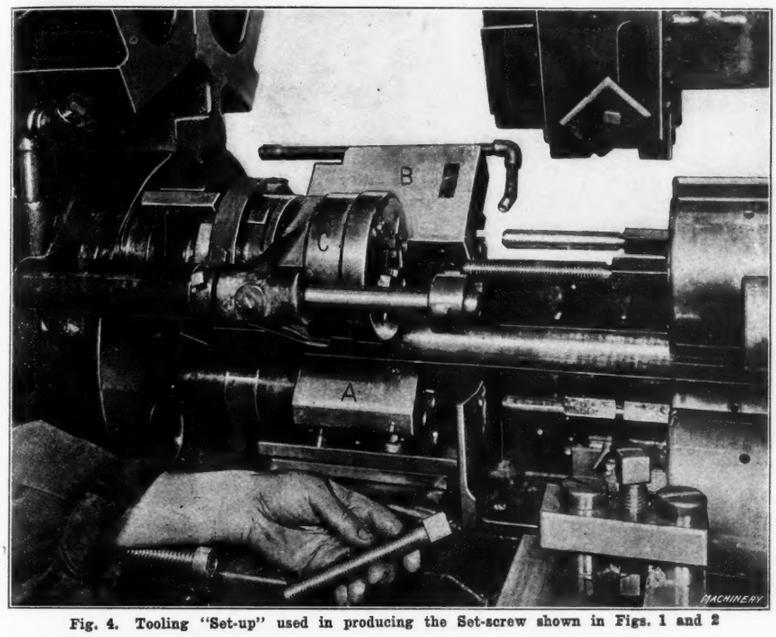


Fig. 4. Tooling "Set-up" used in producing the Set-screw shown in Figs. 1 and 2

The next step is to determine the number of revolutions necessary for the box-tool to travel up half the length of the screw—2⅞ inches. Deciding on a feed of 0.0045 inch per revolution of the work, the number of revolutions required to make this cut is found to be 640. As the spindle makes 635 revolutions per minute, the time, in seconds, to turn half the body is $\frac{60}{635} \times \frac{640}{1} = 60.47$ seconds. Adding to this the time for the idle movements of the machine we get $60.47 + 2.4 = 62.87$, or approximately 63 seconds. This gives us a product of 57 pieces per hour, but upon referring to the table of change gears we find that gears to give this product are not obtainable. Therefore it is necessary to do either one of two things—increase the product to 59 and increase the feed of the tools accordingly, or else decrease the product to 51 pieces per hour with a corresponding decrease in feed.

The "set-up" used in making this set-screw is illustrated in Fig. 4. The operations start in the "first" position, where the first box-tool *A* comes into position, turns up half the length of the body—2⅞ inches—and points the end of the screw. At the same time that the box-tool is in operation on the work, the form tool comes in from the side and turns down the neck—also rough-forming the top of the head. As the cylinder is indexed into the "second" position, the second box-tool *B* comes into operation and finish-turns the body. The cylinder is again indexed into the "third" position, where a self-opening die *C* cuts the thread. For a clear description of the operation and application of this die, reference should be made to the article which appeared in the February, 1913, number of MACHINERY. After threading, the cylinder is again indexed and the piece cut off with a straight-blade cut-off tool *D*. These various operations have been described separately, but in actual performance all tools are at work on different bars at the same time.

"Set-up" in which Forming Operation is the Time to Complete One Piece

The knurled head nut shown at *B* in Fig. 1, and in Figs. 3 and 5, represents an example in which the forming is the longest single operation, and is the time to make one piece. This is evident from a glance at Fig. 3 where the dimensions of the piece are given. This knurled nut is made from a 2-inch bar of round brass rod in a No. 56 "Acme" multiple-spindle automatic screw machine.

The first step in determining the time to make this piece is to obtain the correct speed at which to rotate the work. Rod brass can be worked at 150 to 200 surface feet per minute, and by calculation we find that a spindle speed of 290 R.P.M. will give 150 feet surface speed. The next step is to determine the proper feed at which to operate the form tool. Now the conditions under which this thumb-nut is made are ideal as far as a heavy feed is concerned, so the form tool can easily be operated at 0.005 inch per revolution. By dividing this into the travel of the form tool, which is 0.635 inch (allowing 0.010 inch to approach the work) we find that it will require 127 revolutions of the spindle to complete the forming operation.

As this is a case where the longest single operation is performed from the form tool-slide, it will be necessary to calculate the time required in seconds to complete the idle movements of the machine. We find, however, by referring to Fig. 10, in the October number of MACHINERY, that the form cam occupies exactly the same circumferential space as the lead cam; thus we can utilize the same time as that given in the article previously mentioned, which is 4.6 seconds. Then

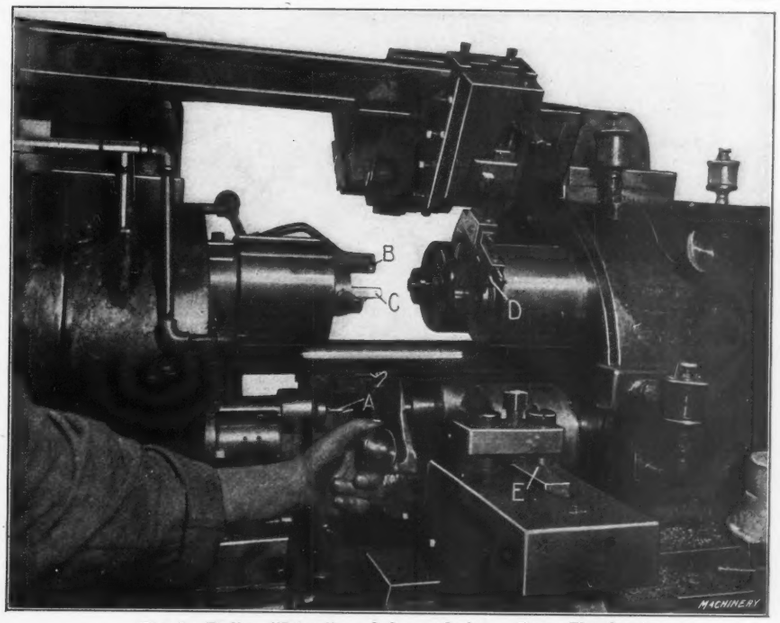


Fig. 5. Tooling "Set-up" used for producing a Brass Thumb-nut

the time in seconds to complete the forming operation equals 26.27 seconds. Adding the time for the idle movements we get $26.27 + 4.6 = 30.87$ seconds. Say that it takes 30 seconds to make one piece, then we get a product of 120 per hour. The nearest production to this for which change gears are obtainable is 122 pieces, and by using the change gears to get this production, we increase the feed of the tools slightly, which in this case could be done with satisfactory results.

In making this thumb-nut, the rough-forming is accom-

necessary to cause the tool to cut into the ring. In addition to being held and supported by the turret slide, the eccentric turning tool and its bracket and the automatic marker are well supported by a bearing plate *O* which has a continuous bearing upon the steel plate that is bolted to the top of the front way of the machine.

The operation of the machine when working on piston-rings is as follows: The piston-ring sleeve casting is held in the universal chuck upon the main spindle of the machine. The boring bar is held on the turret slide and its inner end is piloted in the bushing *P* which may be seen in the line illustration, Fig. 3. This bushing is fitted with a felt washer which keeps dust and chips out of the bushing. The concentric boring tool is, of course, located in the boring bar as shown. The eccentric turning tool is firmly bolted in the eccentric turning slide and receives its motion in the manner just described. As soon as the eccentric turning tool has commenced its cut, the rocker arm with its multiple set of cutting-off tools comes in from the rear. This is clearly shown in Fig. 3, and as the cutting tools are set each slightly ahead of the other, the rings are separated about as soon as the outside portions have been turned and marked. An idea of the speed at which piston-rings are made may be gathered from the fact that a casting which will make thirteen piston-rings, 5/16 inch wide and 4 1/4 inch diameter, is put into the machine and the thirteen rings are turned, marked and cut off in 4½ minutes.

The cutting-off tools carried by the rocker arm are first adjusted and set in position in a removable block that is, in turn, held on the rocker arm. This block, with the tools intact, can easily be removed at any time for resharpening and the block returned without affecting the adjustment of the machine in any way.

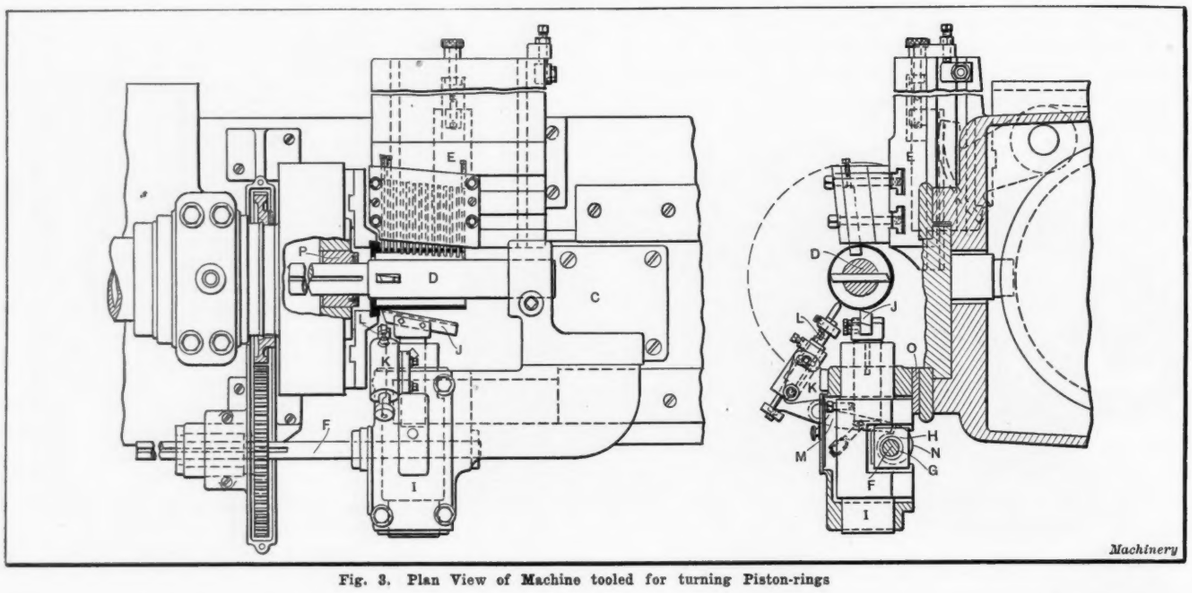


Fig. 3. Plan View of Machine tooled for turning Piston-rings

When working on pistons, the tool set-up is about as shown in Fig. 4. Here the piston is shown at *A*, being held in place upon the spindle nose *B* by means of a cross pin *C*, passing through the wrist-pin hole, which is drawn back by a draw-back bar *D*. The draw-back bar is quickly operated by means of lever *E*. The pistons are bored and turned on the open ends before coming to this machine. When used for piston-turning, no eccentric turning slide is necessary, so the bracket supporting the eccentric turning and marking fixtures is removed. The turning bar *F* is operated from the turning slide *G* and its outer end is piloted in a bracket *H* bolted to the frame of the machine. By thus piloting the turning tool, great stiffness is secured. A centering tool is located at the front of the turning slide. The grooving tools *J* and the end turning tool *K* are operated from the rocker arm, these being substituted for the cutting-off tools used in piston-ring turning. As in the case of piston-ring turning, the

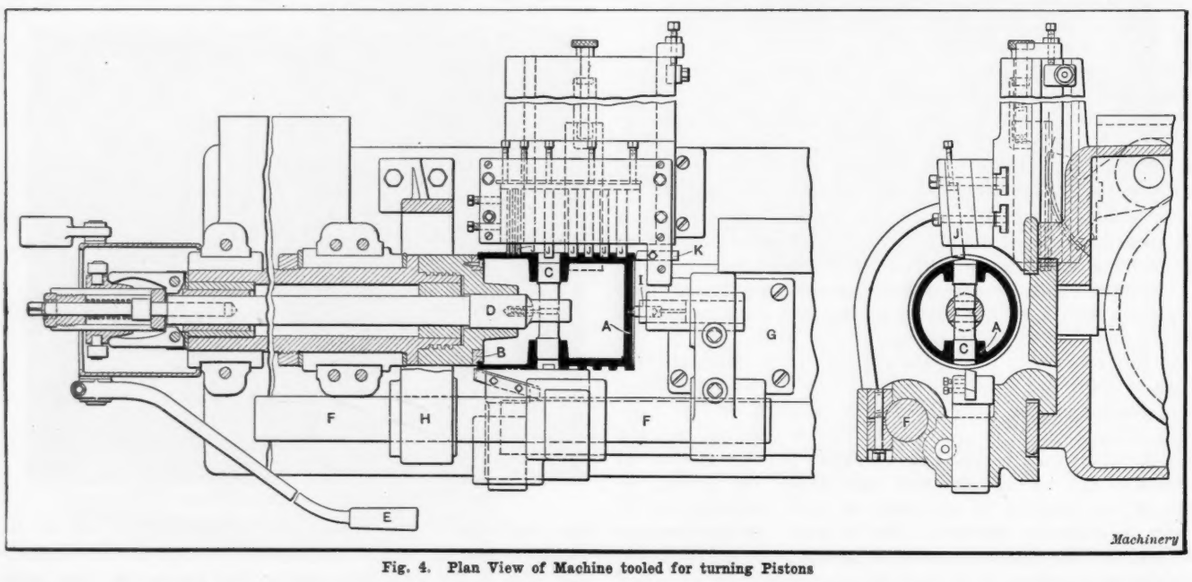


Fig. 4. Plan View of Machine tooled for turning Pistons

different operations on the pistons are performed simultaneously, being centered, faced, turned and grooved at the same time.

In accordance with recognized practice, pistons are finished on this machine in two operations, roughing and finishing, sufficient time being allowed to elapse between these operations to insure accuracy. The turning time for pistons, 3¾ diameter by 3¾ inch long, is 6 minutes. This includes roughing and finishing.

STANDARD ROLLING MILLS

The accompanying illustrations show two rolling mills which constitute an addition to the line of machines manufactured by the Standard Machinery Co., Elmwood Ave., Auburn, R. I. The machine shown in Fig. 1 is a light mill with rolls 5 inches diameter by 8 inches face width. This machine is equipped with a constant-speed motor used in connection with a special Cutler-Hammer controller which allows the mill to be started and stopped by a foot treadle.

Beneath the bed of the machine there is an oil switch which is connected to an automatic switch shown in the illustration; this arrangement allows the operator to press down and lock the treadle on the special treadle stand which has a shoulder on it. When the rolling operation is finished,

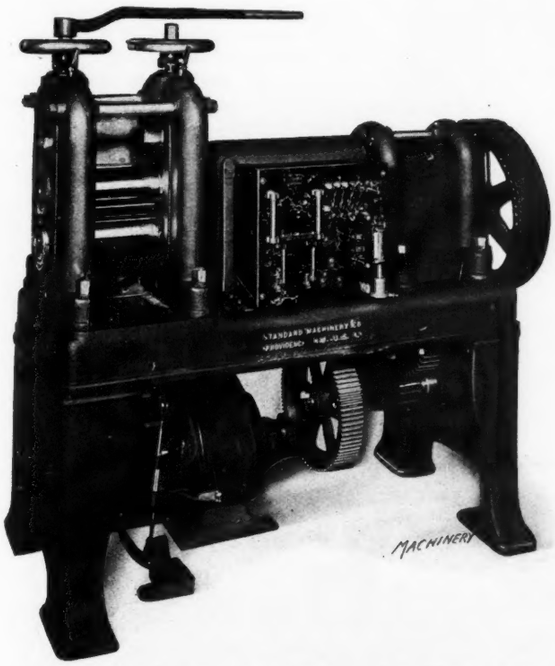


Fig. 1. Standard Rolling Mill with Constant Speed Motor Drive

the treadle is pushed to one side, allowing it to snap back through the action of a spring and thus shut off the current from the motor. Exclusive of the motor train, the machine is driven through a triple train of gearing which includes the intermediate and driving trains on the machine proper with cut steel herringbone gears in the housings. The motor pinion is of rawhide and meshes with a cut steel gear on the driving shaft. The teeth of all of the gears are cut.

The machine is equipped with hardened and ground rolls of special Krupp steel. These rolls have hardened and ground journals which run in the Standard roller bearings. The face of the rolls are mirror lapped. The housings are fitted with handwheels with micrometer dials. The principal dimensions of the machine are as follows: Sizes of rolls, 5 inches diameter by 8 inches face width; back gear ratio, 16 to 1; floor space occupied, 7 by 2½ feet; weight of machine, 3600 pounds.

Fig. 2 shows a machine which is a modification of the rolling mill illustrated in Fig. 1, the former machine being arranged for belt drive. The special features of this machine consist of making the bed all one piece and doing away with the legs and bearing bracket below the separate bed. This construction makes a self-contained machine of the same dimensions as the one previously described. All of the bearings are bronze bushed. The clutch is of the cone type and permits the mill to be started and stopped without requiring the operator to use his hands, the clutch being

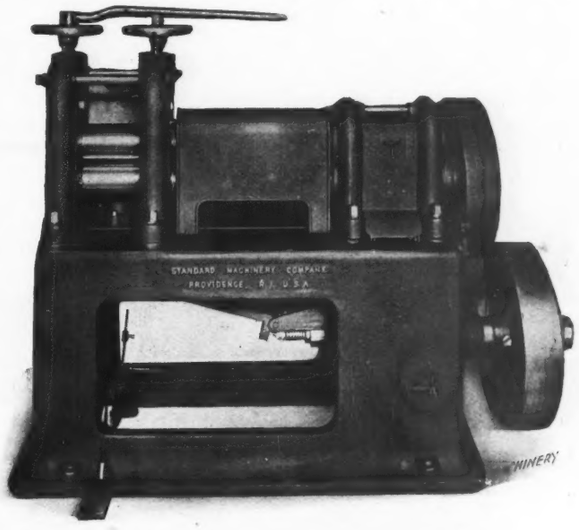
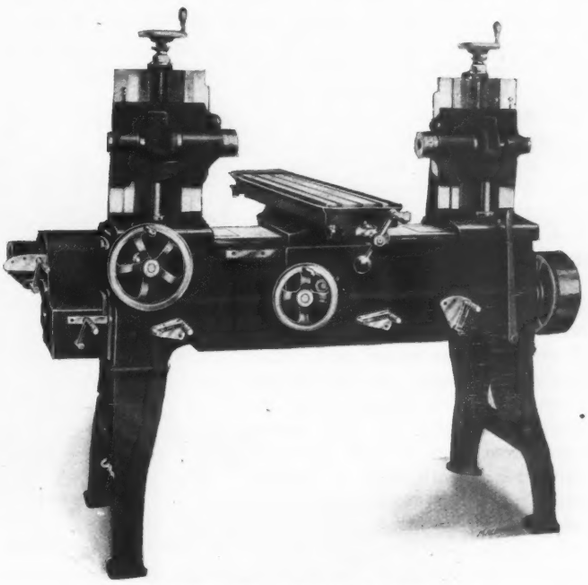


Fig. 2. Same Type of Mill arranged for Belt Drive

thrown in and out by means of a spring mechanism on the driving shaft.

KNIGHT DUPLEX MILLING MACHINE

The light duplex milling machine illustrated herewith is a recent production of the W. B. Knight Machinery Co., 2019-25 Lucas Ave., St. Louis, Mo.. This machine has been designed for manufacturing work where it finds application on



Knight Duplex Milling Machine for Light Work

many light jobs that can be milled on two sides simultaneously. The duplex machine cuts the operating time exactly in half, and as a second setting of the work is saved, the chucking time is also reduced 50 per cent. Among the classes of work which this machine will handle, the following may be mentioned: milling the frames of typewriters, adding machines, cash registers and similar parts where lugs occur in pairs and are to be finished on opposite sides of the casting; and milling flats, squares and hexagons on shafts, tools, etc. The work may either be handled by putting a number of

pieces vertically in a jig and passing them between two end mills to finish opposite sides simultaneously, or by bringing the heads closer together and driving two cutters in opposite directions with one cutter above the other.

As the machine is particularly designed for the class of work which has been referred to, the longitudinal feed of the table is the only one required. The table is provided with a quick return at 7½ times the feed. The feeds and speeds are obtained through gears which are fully enclosed, and the feed and adjustment screws are fitted with graduated collars. The spindles run in adjustable bronze bearings. Both the uprights carrying the spindles are controlled by one handwheel which moves them toward or away from each other simultaneously. This handwheel has a graduated set collar to indicate the distance that each head has moved. The heads can be raised or lowered on the uprights, independently of each other and graduated scales on the vertical ways and graduated set collars on the vertical screws facilitate an exact adjustment which is matained by means of lock nuts. Both the uprights and saddle carrying the table are also clamped to the bed of the machine by means of lock nuts.

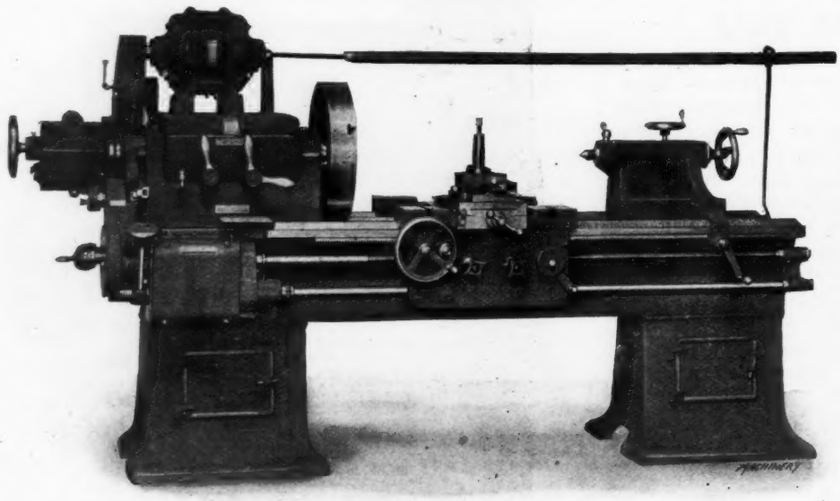


Fig. 1. Whitcomb-Blaisdell Geared Head Lathe with Single Pulley Drive

Gears contained in the bed of the machine provide six changes of spindle speeds, the same gear box controlling both of the spindles. The drive is through gears which transmit power from the single clutch pulley at the end of the bed. At the opposite end of the machine from the driving pulley there is another gear box which controls the longitudinal feed of the table. There are six all-geared feeds instantly obtainable, the feed range being from 0.008 to 0.060 inch per revolution. Both sets of change gears run in oil and all levers controlling changes of speeds and feeds are conveniently located at the front of the machine. Adjustable gibs are used to compensate for wear between the spindle heads and the uprights. The principal dimensions of the machine are as follows: maximum distance between spindles, 22 inches; height of spindles from bed, 2 inches to 9 inches; range of spindle speeds, 50 to 400 R. P. M.; working surface of table, 8½ by 32 inches; longitudinal table feed, 24 inches; floor space occupied, 73 by 73 inches; net weight of machine, 1550 pounds.

This machine is to be exhibited at the Boston Auto Show, Mechanics' Bldg., March 9 to 14.

WHITCOMB-BLAISDELL GEARED HEAD LATHE

The Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass., has recently added to its line of lathes a geared head machine which is illustrated herewith. The changes of spindle speeds on this machine are obtained through sliding clutches which are so arranged that it is impossible to engage two speeds at the same time. The idea in bringing out these machines was to meet the demand for a powerful geared head lathe which is adaptable for either single pulley drive from the line-shaft or direct-connected motor drive through a constant-speed motor. The design combines the features of simplicity and durability.

A noteworthy feature of these machines is that the spindle may be stopped, started or reversed from the operating position without requiring the use of a countershaft or reversing motor equipment. This feature is obtained through the application of two clutches and gearing located in the reversing friction gear box at the head end of the lathe. Although a single speed motor is entirely satisfactory it is, of course, possible to use a 2 to 1 or 3 to 1 variable speed motor, but the variable speed motor is by no means necessary. In addition to the reversing geared headstock, these machines include all of the regular features applied on Whitcomb-Blaisdell lathes. The line includes machines ranging from 14 to 30 inches.

ALLEN SOCKET FILLISTER SCREW

In the November, 1910, number of MACHINERY, the safety set-screw made by the Allen Mfg. Co., Inc., 135 Sheldon St., Hartford, Conn., was illustrated and described. This company has recently brought out a fillister-head screw which is turned by a key fitting in a socket in the head; one of these screws is illustrated herewith, and little description will be necessary to point out its features. This form of screw will stand up under hard service where the slotted head screws soon become so badly worn that it is very difficult to turn them. Anyone who has had any experience in turning ordinary fillister-head screws with a screwdriver knows that the slot often becomes battered in a way which makes the screw very difficult to turn.

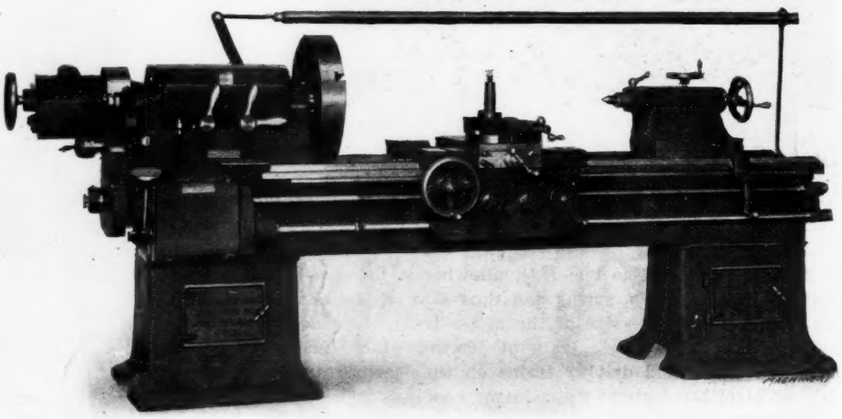
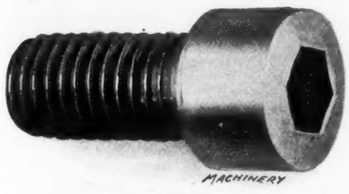


Fig. 2. Whitcomb-Blaisdell Lathe with Electric Motor Drive

The application of the socket head idea on fillister screws enables the screw to be turned up fully as tight as an ordinary

hexagon headed capscrew. As no clearance is necessary around the head, these screws can be conveniently used in many places where there would not be sufficient clearance for a hexagon headed screw. The heads of the Allen fillister screws are trimmed so that the head and body are in perfect alignment. Screws of this kind improve the appearance of a machine and constitute a good "talking point." At the present time the Allen Mfg. Co. is making screws of this kind in sizes ranging from 3/16 to ¾ inch, and in any length. Other sizes will be added to the line from time to time.

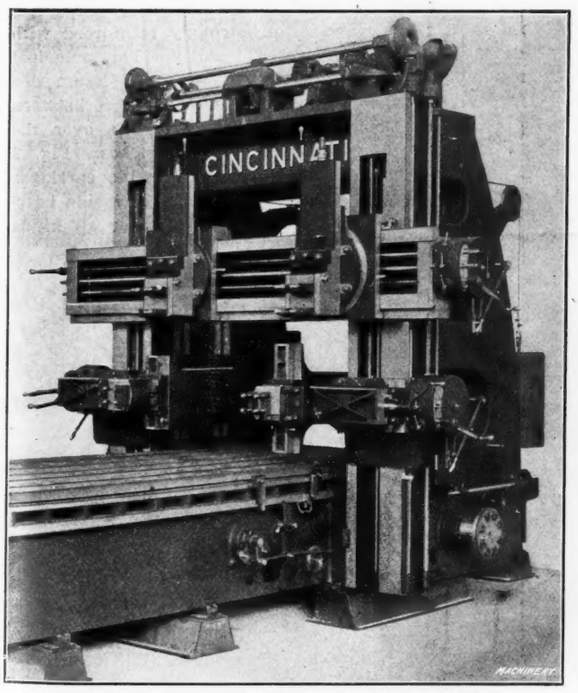


Allen Socket Fillister-head Screw

CINCINNATI LOCOMOTIVE CYLINDER PLANER

In the January, 1914, number of MACHINERY a large size planer built by the Cincinnati Planer Co., Cincinnati, Ohio, was illustrated and described. The accompanying illustration shows a machine of similar design which has been built for planing locomotive cylinders. This machine has a capacity of 72 by 72 inches and has rapid power traverse to all heads in any direction. All movements are independent of each other and can be operated whether the table is in motion or not.

The special feature of this machine lies in the provision of the auxiliary side head supports. The heads are provided



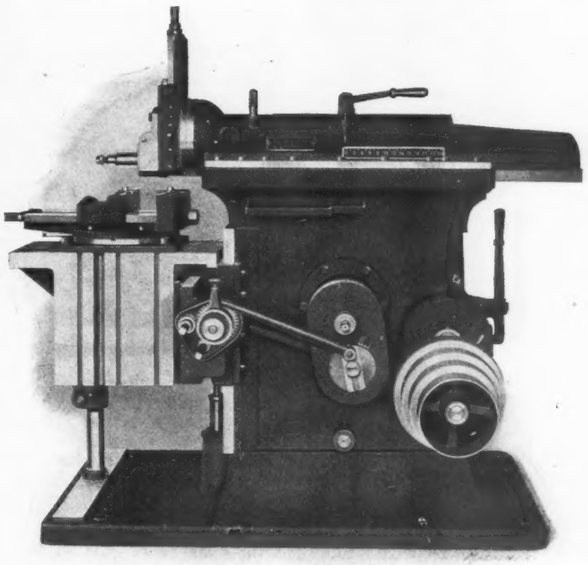
Cincinnati 72 by 72-inch Locomotive Cylinder Planer

with extra brackets which are rigidly bolted to the inside of the housing; these brackets support the slides while the machine is engaged in planing the frame fits and similar operations. They are adjustable for height and can be used in any position between the top of the table and the bottom of the cross-rail. A sliding shoe fits the front face of the brackets and has a dovetail on it which the cross-slide fits. This construction eliminates all twisting strains on the face of the housing caused by the long overhung slide and the upward pressure of the tool. These special brackets can be easily removed from the machine, thereby converting it into a standard planer. This planer is built in various sizes and lengths.

R. A. KELLY SHAPER

The accompanying illustration shows a shaper which constitutes a recent addition to the line of machines manufactured by the R. A. Kelly Co., Xenia, Ohio. The feed on this machine is through a ratchet and plunger mechanism, the ratchet being covered over the greater part of its circumference. The stroke of the pawl is always the same amount, so the feed depends upon the number of ratchet teeth that are exposed. The ratchet cover is prevented from turning, through the action of a spiral spring that holds it just tight enough so that it can be turned by hand.

The shaft which carries the ratchet cover is fastened to a



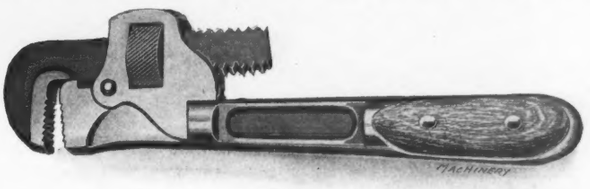
R. A. Kelly Shaper

radius rod, the other end of which is fastened to the radial gear guard carrying the lower feed gear. When the cross-rail is raised or lowered, the shaft carrying the ratchet cover rotates just enough to keep the same number of teeth in the ratchet exposed. In this way the cross-rail may be lowered from the highest to the lowest position or *vice versa* and no adjustment is needed.

The advantages of this feed mechanism are that it may be started, stopped, changed from a maximum to a minimum or reversed when the machine is in motion, without requiring any moving part to receive attention from the operator.

SMITH PIPE WRENCH

The accompanying illustration shows the Smith "perfect handle" pipe wrench which is a recent product of H. D. Smith & Co., Plantsville, Conn. The feature of this wrench is the handle which is both strong and convenient for the



Smith "Perfect Handle" Pipe Wrench

operator to hold. The swell at the end of the handle prevents the hand from slipping off and the wooden inserts make it comfortable to use in extremely hot or cold weather.

BRIDGEFORD AXLE LATHE

The accompanying illustrations show a center drive gap axle lathe with two carriages, which the Bridgeford Machine Tool Works, Rochester, N. Y., has recently designed for use

in railroad shops. This machine is intended for turning journals of car axles without removing the wheels, and as it is equipped with two carriages, both ends of the axle may be finished simultaneously. This means a considerable saving of time taken to machine a pair of journals. In other respects, the construction of the present machine is similar to that of the regular line of axle lathes built by this company.

The most satisfactory method is to place the machine in a pit so that the axles with the wheels attached to them can be placed on the centers with very little trouble. The driving gear, which is two-pitch with a face width of 5 inches, is completely encased and runs in heavy bronze bearings scraped to an accurate fit. It is furnished with drivers for driving the axle, these drivers operating on the same principle as the self-centering style drivers furnished with the standard Bridgeford axle lathes. The driving gear is in two pieces, tongued and grooved together and secured by four heavy hinged bolts and nuts. These bolts are easily operated by means of a socket wrench and less than one-half turn of each nut is sufficient to release the gear so that it may be opened to allow the entrance of the wheels and axle. The upper half of the driving head operates on a heavy hinge stud in the front of the machine. To lift the head, the pull pin is pushed into place and the nuts are released. An eye-bolt is placed on the upper half of the head and a rope with counterweights is used to lift and lower the head.

The machine is driven by a constant-speed pulley and there are three geared changes of cutting speed. The gears are of steel with cut teeth and run in oil, the changes of speed being accomplished by shifting levers conveniently located on the case. From the speed box, the power is transmitted to the driving head by a shaft located inside the frame of the machine. All driving shafts are of high-carbon steel and run in scraped bronze bearings.

There are four instantaneous changes of feed ranging from 1/16 to 3/16 inch per revolution of the axle. The gears in the feed box are of steel and run in oil; they are operated by a lever placed at the center of the lathe. The tailstocks have bearings 24 inches in length on the bed; they are secured in position by four heavy bolts and binders and the spindles may be adjusted by means of screws and handwheels. The carriages are driven by a splined feed shaft and the direction of the feed is changed at the apron. Each carriage is independent of the other. The carriages have a bearing 30 inches in length on the vees and they also have a bearing at the back of the bed which takes the forward thrust, thus overcoming the tendency to raise the carriages from the vees when the burnisher is used.

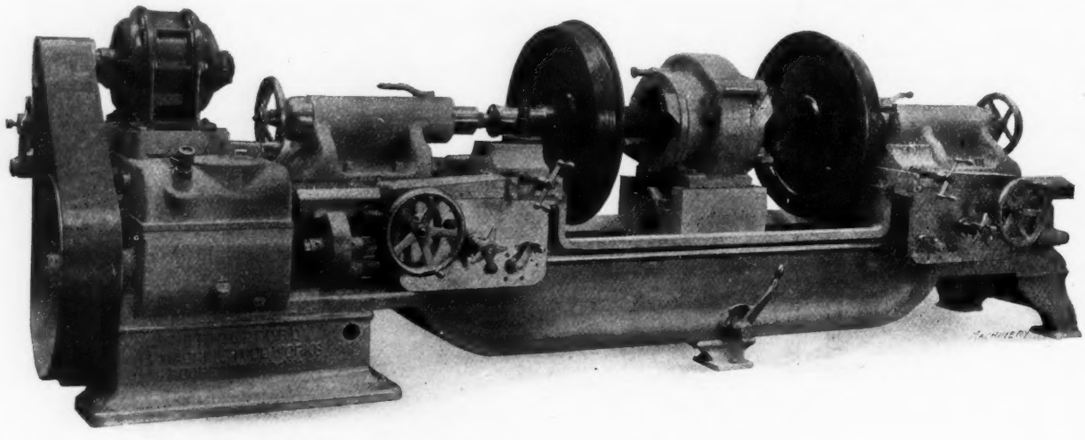


Fig. 1. Bridgeford Axle Lathe equipped with two Carriages

The bed is of rigid construction, strongly reinforced with cross ties to provide the required rigidity. The principal dimensions of the machine are as follows: Minimum distance between centers, 54 inches; maximum distance between centers, 105 inches; swing over ways, 27 inches, over the carriages, 13½ inches and in the gap, 45 inches. Fig. 2 shows a machine equipped with two extra inside carriages for refinishing locomotive and tender axles with inside bearings. Such a machine is exceptionally useful for all kinds of axle repair work. The weight of a lathe equipped with two carriages is 16,000 pounds and a lathe with four carriages has a net weight of 18,000 pounds.

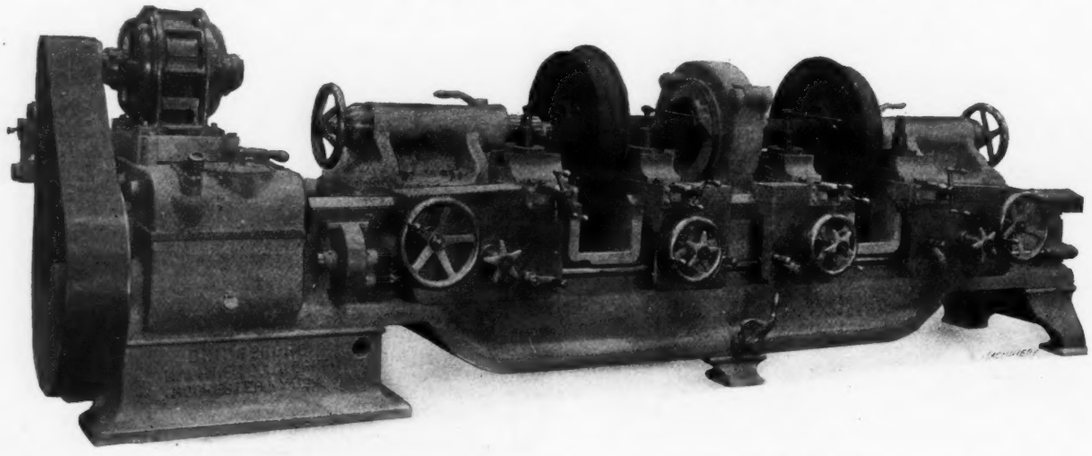


Fig. 2. Bridgeford Lathe with Regular Carriages and Two Extra Inside Carriages

PEDRICK PORTABLE MILLING MACHINE

The notable features of a portable milling machine which has recently been placed on the market by the Pedrick Tool & Machine Co., 3639 Lawrence St., Philadelphia, Pa., are the simplicity of its design, the adaptability of the machine for operation on a variety of classes of work, and the provis-

ion for driving by motor, belt or hand as desired. In a portable tool of this character, simplicity of design means less weight, greater convenience of operation and lower cost. For these reasons, automatic feed has been omitted on the No. 1 machine, hand adjustment for the longitudinal and cross traverse being provided, which serves every purpose. The No. 2 machine, which is considerably larger and intended for a wider scope of work, has automatic feed.

In designing this machine, particular care has been taken to have the construction of ample strength. The spindle bearing is proportioned to give rigid support and to have the

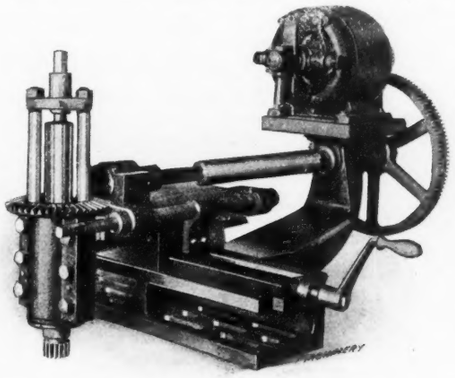


Fig. 1. Pedrick Portable Milling Machine

desired durability; the bed is ribbed in the center and has removable posts at both ends. These posts may be taken out if necessary when setting up the machine, as there are cases when they would interfere with a wrench used for tightening the holding nuts inside the base. There are a number of elongated slots in the base to provide for attaching the machine to the work. An important feature of the design is that the machine will mill a surface level with the surface on which it is attached or several inches below it. The machine does not "smother" the job and it will face a small valve seat just as easily as one of the maximum size that it is capable of machining. The machine will work with equally satisfactory results in either a horizontal or vertical position.

The spindle and quill revolve together and there are no shoulders or collars to wear and allow the cutter to flinch

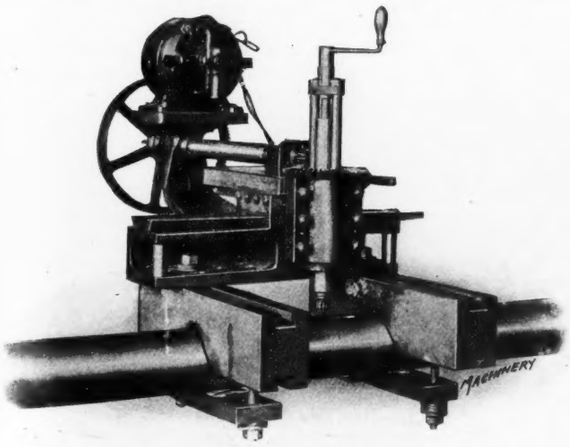


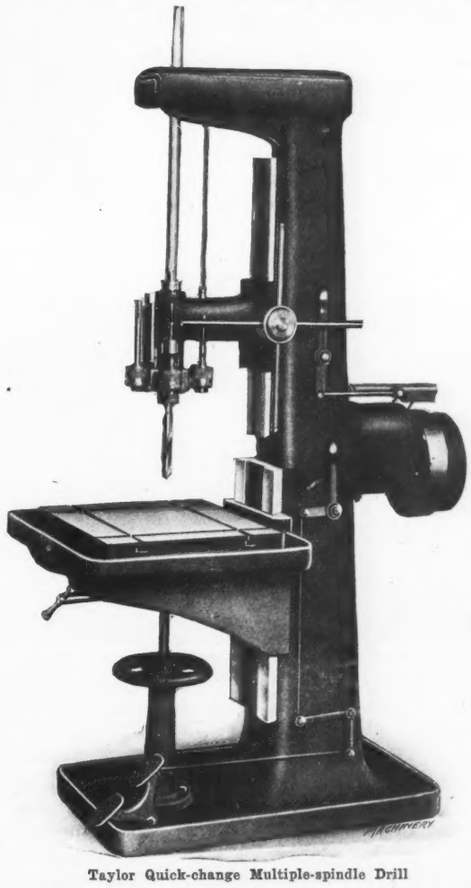
Fig. 2. Pedrick Machine milling a Keyway in a Shaft

away from the work. Another feature is that when the cutter is no larger than the diameter of the spindle, it may be lifted out of the bearing with the spindle to enable the cutter to be sharpened or a new one to be used. This is accomplished by merely loosening two nuts and is found to be a particularly convenient feature of the machine, because if a cutter is working in a small deep chest where there is not sufficient room to reach in and unscrew it, it is not necessary to remove the entire machine. The spindle has a standard taper so that an ordinary cutter may be used.

The telescopic driving shaft works smoothly and quietly throughout its full range, and is of ample strength to meet the requirements of any service for which the machine is intended. The No. 1 machine will face a surface up to 12 by 8 inches in size, and the spindle has a vertical adjustment of 6 inches. The direct motor drive is arranged as shown in the illustrations, and a machine equipped in this way is a self-contained unit that may be used in close quarters and easily set up. Besides using the machine for milling seats in pumps and engines, or pads on large frames and housings, it is found to constitute a very convenient means of machining keyways in shafts. While not particularly designed for the purpose, this machine may also be used for drilling.

ROBBINS MULTIPLE-SPINDLE DRILL

The Taylor quick-change multiple drill press illustrated herewith is a recent product of the Robbins Machine Co., Worcester, Mass. This drill was designed to meet the demand for a machine of the sensitive drill type with sufficient power to handle work beyond the capacity of a sensitive drill press, and at the same time operate quicker than a standard



Taylor Quick-change Multiple-spindle Drill

upright drill. It will drive a 1¼-inch drill as easily as the ordinary sensitive drill press will handle a ¾-inch drill. The feed is by hand, and when large drills are to be used at high speed, compound gearing in the sliding head can be quickly engaged to increase the pressure of the drill and decrease the pressure required on the hand lever. This enables a large drill to be forced to its full capacity by the application of a limited amount of hand pressure. The reverse motion of the spindle is of unusual strength and provides ample power to handle reasonably large taps.

The machine is driven by spiral gears running in oil, and all gears that are subjected to excessive strain are made of heat-treated nickel steel. The quick-change gear-box is arranged for four spindle speeds and one reverse speed for tapping. The spindle speeds are quickly changed without requiring the machine to be stopped. The sliding head affords quick action in raising or lowering the spindles for tools of different lengths.

The quick-change drill chuck is designed to hold five tools such as drills, reamers, counterbores, taps, etc., which are required for performing successive operations on a piece of work. This chuck provides for rapidly moving any tool to the working or idle position without stopping the machine. When the tool to be used is swung to the operating position it is securely locked and held in perfect alignment with the driving spindle. The power is applied through a combination clutch and friction device, and the greater the strain on the tool the more powerful the drive becomes. When the machine is in operation all tools in the chuck are idle with the exception of the working tool. The clutches for holding the tools in the chuck are made to fit either No. 1, 2 or 3 Morse taper shanks.

The machine is ball bearing throughout and is practically noiseless in operation. The principal dimensions are as follows: distance from center of spindle to face of column, 10 inches; maximum distance from table to spindle, 30 inches; traverse of table, 12 inches; traverse of spindle, 16 inches; size of work-table, 18 by 24 inches; diameter of spindle, 1¼ inch; and net weight of machine, 1200 pounds.

MURCHEY PIPE THREADING DIE

The accompanying illustrations show a pipe threading die which has recently been placed on the market by the Murchey Machine & Tool Co., Porter and Third Sts., Detroit, Mich. The important feature of the design of this die consists of the four circular chasers which are similar in shape

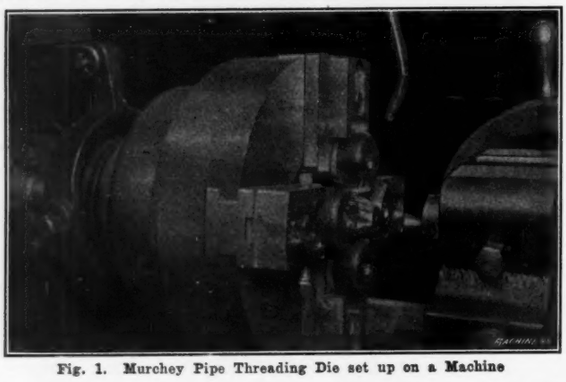


Fig. 1. Murchey Pipe Threading Die set up on a Machine

to circular forming tools. These chasers are provided with a series of annular V-grooves properly spaced for the pitch of the thread that it is desired to cut.

The circular chasers are carried by slides which fit in T-slots in the die head, the construction being clearly shown in Fig. 1. Interposed between the top faces of these slides and the chasers, there are adjusting plates, each of which has nine holes which are equally spaced. Three pins held in the chasers fit into these holes and adjustment of the position of the chasers is effected by loosening the square screws, lifting the chasers up and turning them around so that the three pins enter another set of holes. The cutting edge of the chasers is then set in the correct relation to the center of the work by adjusting the set-screws in the slides.

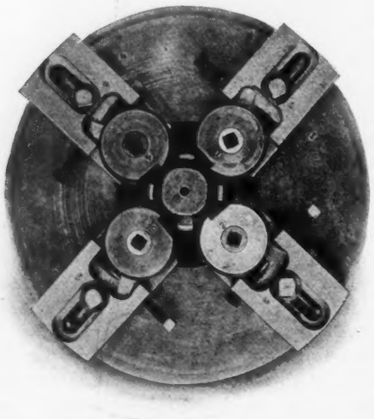


Fig. 2. End View of Murchey Pipe Threading Die

In order to cut the thread on a taper, the top faces of the slides against which the chasers are held are beveled. This serves to throw the chasers to the required angle. Different diameters of pipe are threaded by the substitution of circular blocks of varying lengths in semicircular grooves provided in the top face of the die head and the lower surfaces of the slides. The chasers can be resharpened until practically the entire circumference is ground away so that their life is much longer than that of the ordinary type of die chasers. A reamer is shown in Fig. 2 which is held in the die head to remove the burrs from the end and hole in the pipe.

STOCKBRIDGE KNIFE GRINDER

The time spent in removing and replacing the knives of planers and jointers used in wood-working shops constitutes a large part of the time involved when it is necessary to take them off for grinding. This is a difficult and unsatisfactory method, and is often done hurriedly and improperly, with the result that the machine when started up operates inefficiently and produces a poor grade of work. This is especially true of the thin hard knives used on cylindrical head planers which are almost impossible to grind and reset in perfect alignment for the entire length of the head.

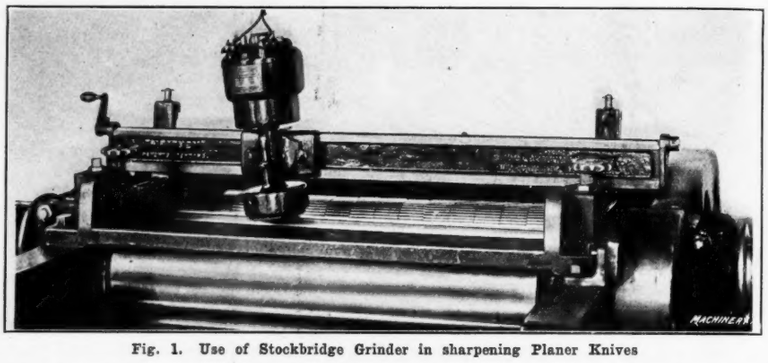


Fig. 1. Use of Stockbridge Grinder in sharpening Planer Knives

In the "Quicsharp" grinder, which is a recent product of the Stockbridge Machine Co., Worcester, Mass., these difficulties are avoided by providing a grinder which enables the knives to be sharpened while in place on the machine. The grinder is motor-driven, the motor being mounted on the head and supplied with a current from an ordinary lamp socket. The saddle has a split nut attached to it which engages the feed-screw located at the top of the bridge. The saddle can

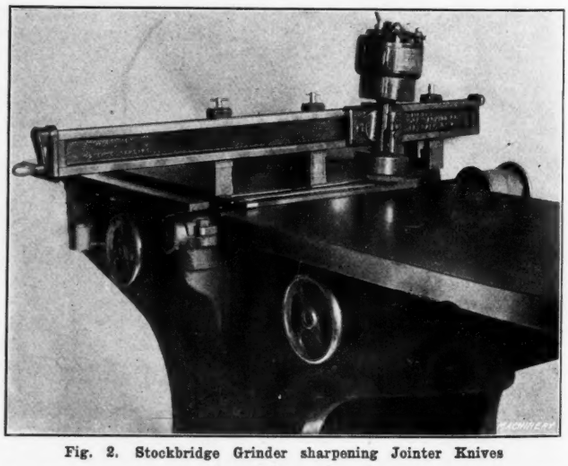


Fig. 2. Stockbridge Grinder sharpening Jointer Knives

be fed across the entire length of the bridge in either direction and at any desired speed. The bridge is supported at the ends or at intermediate points by two angular brackets, which are bolted to the bed of the wood-working machine, and hold the grinder perfectly rigid. The wheel is cup-faced and can be raised or lowered by a thumb-screw to grind the required amount from the knives. The wheel is fed automatically to a positive stop. The grinder head is pivoted at

the center and can be tilted to either side of the perpendicular; it is held in place against a stop, giving the same angle on each side of the perpendicular. With the head tilted, the knives are ground concave. A positive stop holds each knife in exactly the same relative position to the wheel; therefore, each knife must be ground true. Figs. 1 and 2 show this grinder in use on a planer and on a jointer, and reference to these illustrations will show the way in which it is used, making further description unnecessary.

DERIHON PORTABLE HARDNESS TESTING MACHINE

The illustrations presented in this connection show a portable machine for conducting the Brinell hardness test, which consists of making an impression with a hardened steel ball 10 millimeters in diameter, by the application of a pressure of 3000 kilograms. Fig. 1 shows the machine ready for the test with the lever resting on the shaft. The piece to be tested is placed on the table of the machine, which is then raised until the piece is in contact with the ball. This done, the lever is pulled slowly over so as to give a progressive pressure which is registered by a small manometer until 3000 kilograms is applied. When this figure is reached the lever is slowly returned to its former position and the test is completed. Under normal conditions it is usually sufficient to move the lever through an angle of 45 degrees to obtain the required pressure of 3000 kilograms.

With each machine a small piece of steel is furnished in which a standard impression has been made, the size of the diameter being stamped on it. This standard piece is of special air-hardening chrome-nickel steel. The accuracy of the machine can be easily controlled by making an impression beside the standard impression. The construction of the machine is based on the principle of elasticity of the frame, which for this purpose has been constructed in the shape of a horse-shoe. The power produced by the pressure of the ball on the test piece has a tendency to open the frame to a certain degree in proportion to this power. The shape of the frame has, therefore, been specially considered in order to have it as elastic as possible. The pressure exerted of 3000 kilograms does not change the resistance or elasticity of the frame, as it is made of steel having an elastic limit of 242,000 pounds per square inch and a pressure of 3000, 4000 or even 5000 kilograms does not work it above 10 kilograms per square millimeter or 1442 pounds per square inch. Under these conditions, repeated tests even in large numbers do not alter the calibration of the machine.

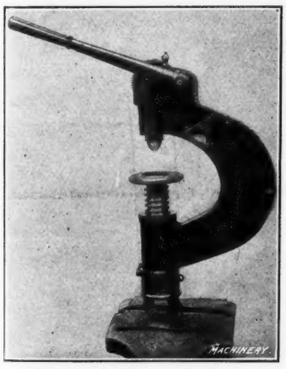


Fig. 1. Machine ready for making Test

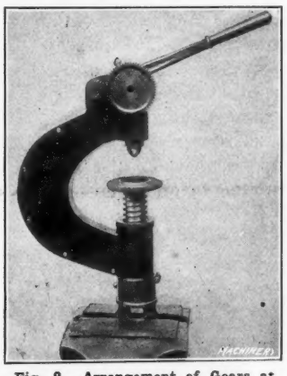


Fig. 2. Arrangement of Gears at Rear of Machine

The deflection of the frame being relatively weak (1 to 1.5 millimeter), a register, the construction of which resembles a metallic manometer, is installed in the hollowed out part of the frame. By means of a needle and a graduated dial, the deflection and therefore the pressure exerted in making the test can be quickly and easily read. To adjust the machine, all that is necessary is to open the head enclosing the mechanism above the frame. Should the machine ever get out of adjustment, a comparison should be made on the standard test piece, and when an impression of the same diameter has been made, the needle is brought over the figure "3000" by means of the small adjusting screw. This adjustment, however, would only be necessary through some accidental cause independent of the operation of the machine under normal usage. Fig. 2 shows the arrangement of the gears at the rear of the machine. This machine is placed on the market by H. A. Elliott, 507 Majestic Bldg., Detroit, Mich.

SCULLY-JONES ADJUSTABLE SPACING COLLAR

Fig. 1 shows the "Wear-ever" adjustable spacing collar for use on milling machine arbors, which is a recent product of Scully-Jones & Co., 349 Railway Exchange Bldg., Chicago, Ill., and Fig. 2 illustrates the method of using these collars. The "Wear-ever" collar was designed primarily for use in connection with manufacturing operations on milling machines, where two or more cutters on an arbor must be spaced at a specified distance from each other. Those familiar with the application of straddle or gang cutters in milling machine operations know that it is sometimes necessary to grind the sides of the teeth. This necessarily changes the distance between the faces of the cutters, and in order to maintain the required dimensions of the work, compensation must be made for the amount which has been removed from the cutters by grinding. This is sometimes done by carrying solid spacing collars of assorted lengths in stock. But if the exact size cannot be found among the collars on hand, it is necessary to grind down a collar that is too long or to shim up one that is too short. While this is being done the milling machine is standing idle.

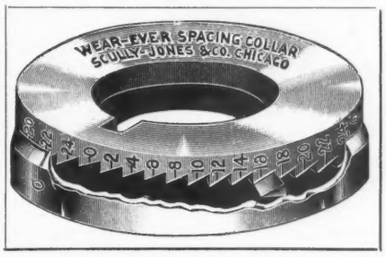


Fig. 1. Scully-Jones Adjustable Spacing Collar

The "Wear-ever" collar is designed so that the thickness may be varied up to 0.024 inch, this adjustment being divided into twelve steps of 0.002 inch each. It will be seen from Fig. 1 that the collar is provided with three sets of graduations ranging from zero to 24 by even numbers, each graduation being opposite a notch in the collar. These notches are arranged on cam surfaces, and corresponding notches in each of the three series of graduations are engaged by a tooth. In making the adjustment, the collar is moved around so that the teeth engage with the proper spaces to give the required expansion of the collar on the arbor. The adjustment is quickly made, and after the collar has been set it is exactly as rigid as a solid collar. The advantages of the "Wear-ever" collar may be briefly summarized as follows:

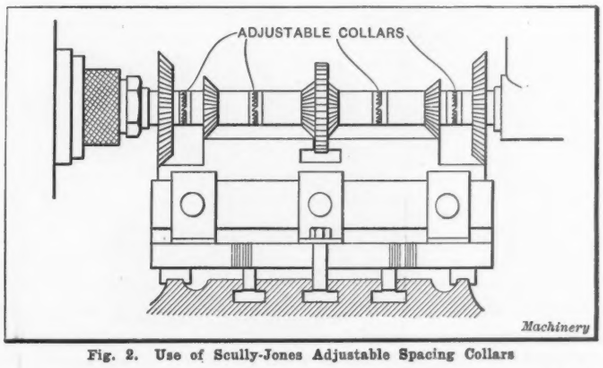


Fig. 2. Use of Scully-Jones Adjustable Spacing Collars

they are made in sizes down to less than ½ inch in width and are capable of standing up under hard service; it is impossible for chips to interfere with the operation of the collar, and the first cost is low so that a shop can afford to purchase them for any work upon which they could be used to advantage.

LOWE "LAST-WORD" INDICATOR

Henry A. Lowe, 1374 E. Eighty-eighth St., Cleveland, Ohio, is now manufacturing the "Last-word" test indicator which is illustrated in Figs. 1 and 2. Fig. 1 shows the indicator carried on the ball joint toolpost shank, and this illustration also shows an auxiliary clamp which is provided with the instrument. This clamp enables an instrument to be removed from the toolpost shank and set up on the needle of a surface gage as illustrated in Fig. 2. There is ball joint connection between the toolpost shank and the indicator, which provides adjustment to meet the requirements of a great variety of work.

Fig. 1. Lowe Test Indicator carried on Ball-joint Toolpost Shank

The contact lever has a hardened taper-head stud for a bearing, which provides adjustment for wear. There is a small tapered hole through the contact ball, and contact points of special shape can be fitted into this hole to meet the requirements of special classes of work. In many cases the ordinary contact ball is quite satisfactory without providing any auxiliary point.

The mechanism of this indicator has been worked out to give the magnifying power of 100, and at the same time the instrument is of remarkably small size, which will be appreciated when it is known that the weight is only 1¼ ounce. The dial is graduated to read in 0.001 inch. This instrument can be quickly changed from the toolpost shank to the needle of a surface gage to adapt it for surface plate work, or back to the toolpost shank for lathe, shaper, planer, grinding or milling-machine work. It is adaptable for use on a great variety of tool-room and machine-shop operations.

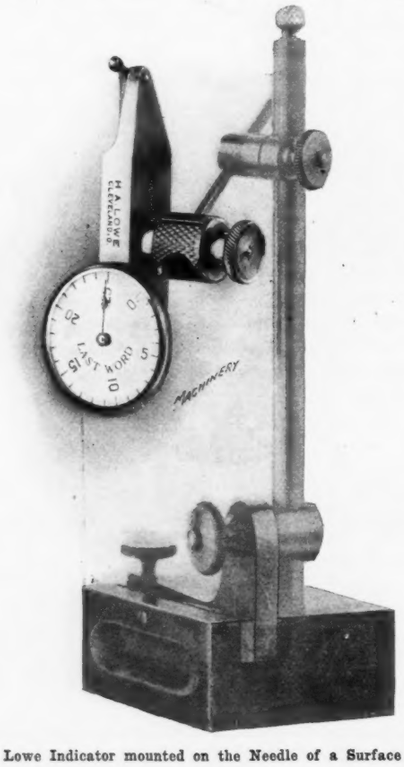
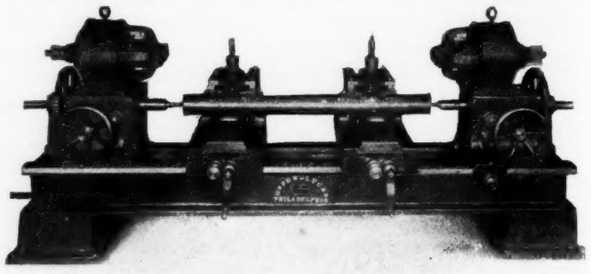


Fig. 2. Lowe Indicator mounted on the Needle of a Surface Gage

ESPEN-LUCAS AXLE CENTERING MACHINE

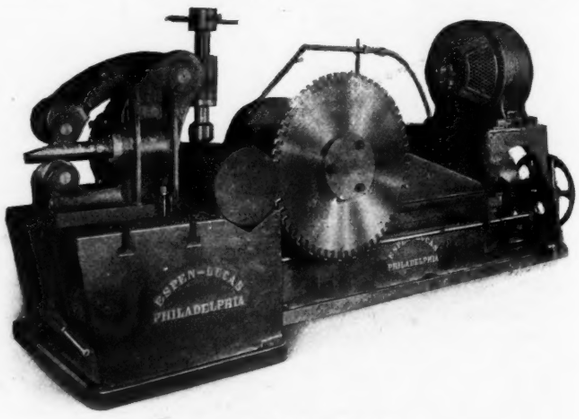
The Epsen-Lucas Machine Works, Front & Girard Aves., Philadelphia, Pa., has recently placed a double-end axle centering machine upon the market. This machine is intended for centering both ends of axles up to 7 inches in diameter by 8 feet long. The machine is arranged with two spindles which are driven independently by 2-horsepower motors. On head is stationary and the other adjustable for centering axles from 5 to 8 feet in length. The two cradles are provided with rollers for centering the axles and heavy clamps for holding the work rigidly in place. The weight of the machine is about 11,000 pounds.



Espen-Lucas Double End Axle Centering Machine

ESPEN-LUCAS COLD SAW

The accompanying illustration shows a heavy type of cold saw which is one of the recent products of the Espen-Lucas Machine Works, Front & Girard Aves., Philadelphia, Pa. This machine is equipped with a saw blade 60 inches in diameter and has a capacity for sawing round or square bars up to 20 inches thick. The feed and speed variations are so arranged that the machine can be used for sawing at an advance of 6 inches per minute. The drive is through a main shaft, a phosphor-bronze worm-wheel and a crucible steel worm running in oil. The spindle extends for the entire width of the carriage and the saw blade is bolted directly against the driving gear, an arrangement which practically eliminates torsional strain between the driving gear and the saw blade.



Espen-Lucas Cold Saw Machine

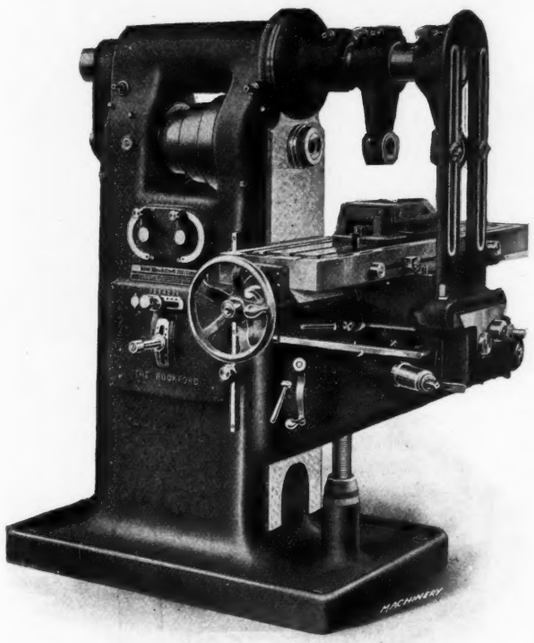
The feed is obtained from a geared friction plate controlled by an automatic lock-nut lever, by which any change in the advance of the saw can be made while the machine is in operation. The saw carriage also has a quick return movement controlled by the same lever. An automatic stop for controlling the traverse of the carriage is also provided. Any type of saw blade including the inserted tooth or solid high-speed steel blades may be used.

Compressed air or screw clamps are provided for use on this machine, depending upon the requirements of individual cases. For handling stock rapidly where multiple cuts are to be made, this saw is equipped with a stock feed attachment which will handle bars of any length up to 20 feet. The usual form of drip pan furnished on machines used for sawing smaller sizes of stock has been eliminated in the

present instance and a reservoir substituted in the foundation. The machine is belt-driven from a 35-horsepower motor and weighs 50,000 pounds approximately.

ROCKFORD HEAVY PLAIN MILLER

The Rockford Milling Machine Co., Rockford, Ill., is now manufacturing the No. 2 heavy double back geared cone type plain miller which is illustrated herewith. This machine is of exceptionally heavy construction, the approximate weight being 3750 pounds. The back gears are enclosed in the column and operated by two levers which afford a very convenient



Rockford No. 2 Double Back Geared Plain Miller

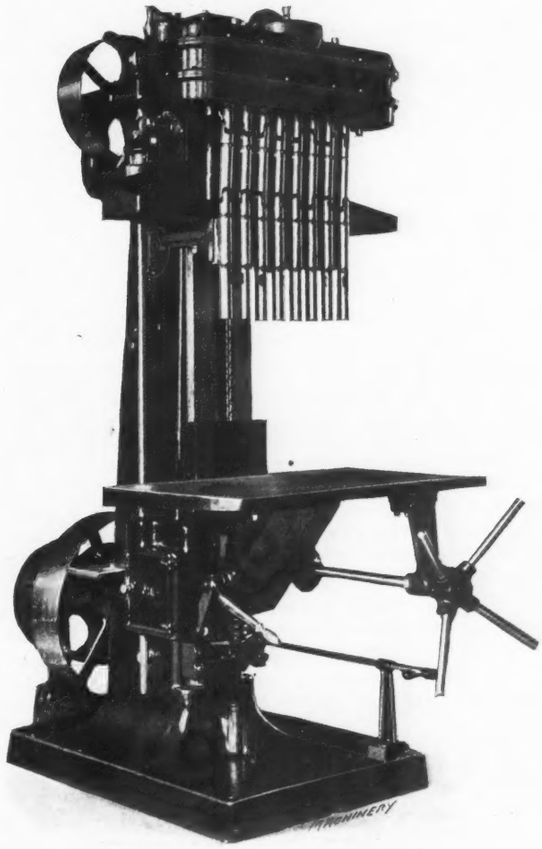
and practical control. The machine is equipped with a flanged support for the overhanging arm, which has been designed by this company; this support stiffens the construction and increases the cutting capacity of the machine. The diameter of the overhanging arm is 4 inches.

The table is provided with a quick return movement operated by a handwheel and clutch, and the handwheel can be thrown in instantly at any desired point. A wrench can be used on the squared shaft at the opposite end of the table. The table measures 50 by 11½ inches over all, and is provided with three ⅝-inch T-slots; there are also oil grooves on the sides and oil pockets at the ends of the table. All feeds are automatic. The spindle is bored No. 11 B. & S. taper, and is made of crucible steel; it runs in phosphor-bronze bushings which have tapered journals fitted with oil retainers. Wear is compensated for at the rear of the spindle by means of a nut. There are eighteen speed changes ranging from 17 to 392 revolutions per minute, and fourteen changes of feed ranging from 0.005 to 0.175 inch per revolution. Feed reverse levers controlling all feeds are located on each side of the knee. The regular equipment of the machine consists of a plain vise, a flanged support for the overhanging arm, two arbor supports and the necessary wrenches. The design has been carefully worked out to secure the maximum rigidity.

FOX MULTIPLE-SPINDLE RAIL DRILL

The No. 3 Fox multiple-spindle rail drill illustrated in this connection has been developed to meet the demand of engine builders for a high-speed multiple-spindle machine for drilling and boring push-rod holes, valve stem guide holes and cages. Particular attention has been paid to the design of the vertical adjustment for each spindle with the view of keeping the cutting edge of all tools in the same plane. This is a feature which users of the machine will appreciate. The base, column and gears for changing the speeds and table feeds are of the same construction which has been used in the past on Fox multiple-spindle drilling machines. The gears are cut from solid 35-point carbon steel blanks, which are pack-hardened and heat-treated. The bearings for the gears are subsequently ground, giving the most perfect construction possible. The principal bearings in the machine are bronze bushed, and the main driving pulleys run on Hyatt roller bearings.

Rails of various lengths are furnished with this machine to meet the requirements of individual cases. The rails are made with either a tongue which fits grooves in the adjusting arms to keep all spindles in positive alignment, or the tongue may be omitted from the rail, giving universal adjustment to each spindle. The rail is an exceptionally heavy casting ribbed to provide the necessary rigidity. The gear case containing the driving pinions for the spindles provides a double bearing for each gear in the case. The gears are of 6 and 8 pitch, with broad faces. The regular gear case is bored for a maximum of twelve spindles and when less than this are furnished with the tool, the extra holes are plugged up; it is thus possible to add additional spindles should they be required at any time. The drill spindles, spindle bearings and adjusting arms are of patented con-



Fox Multiple-spindle Rail Drill

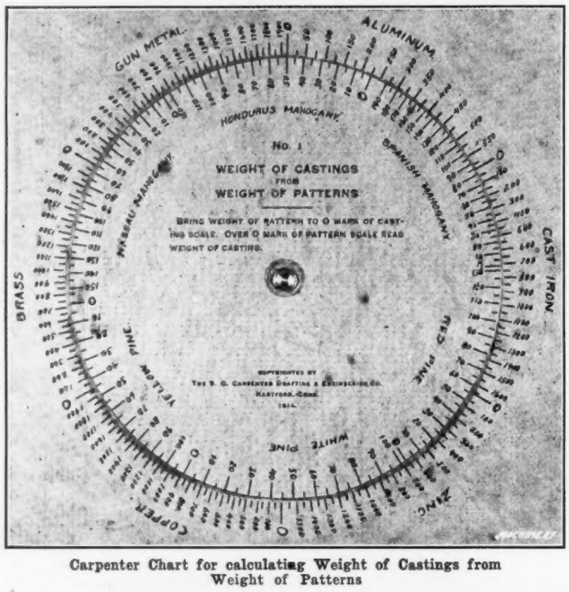
struction, which gives a wide range of vertical adjustment. This adjustment is obtained without changing the set position of the arm. The spindle bearings have a T-slot milled for their entire length and fit into the slotted end of the adjusting arms. T-bolts working in the slots in the bearings secure them to the adjusting arms and provide for adjusting the spindles vertically.

The universal joints used in these machines are made with every friction surface hardened. An oil pocket is provided in the center of the block, giving perfect lubrication. The table regularly furnished on this machine has a surface 24 by 38 inches in size and is equipped with a hand pilot wheel

for raising or lowering. A single lever is provided for manipulating the power feed; pulling up on this lever engages the feed and pushing down on it disengages the feed. An automatic trip lever is provided for automatically throwing out the feed. There are six changes of feed ranging from 0.5 to 5.0 inches per minute; four changes of drill speed are available, depending on the size of drills used. The floor space occupied by this machine is 6 feet by 2 feet 6 inches; the height is 7 feet 8 inches; and the net weight of the machine is 3288 pounds. This machine is a recent product of the Fox Machine Co., 16 Front St., N. W., Grand Rapids, Mich.

CARPENTER CALCULATING CHARTS

The accompanying illustration shows one of a series of eight calculating charts which have recently been brought out by the S. C. Carpenter Drafting & Engineering Co., 49 Oakland Terrace, Hartford, Conn. It will be seen that this chart is intended for finding the weight of castings of different metals from the weight of the patterns from which they are made, the chart being laid out for a number of different kinds of wood commonly used in pattern making. Other charts of this series which are likely to be of interest



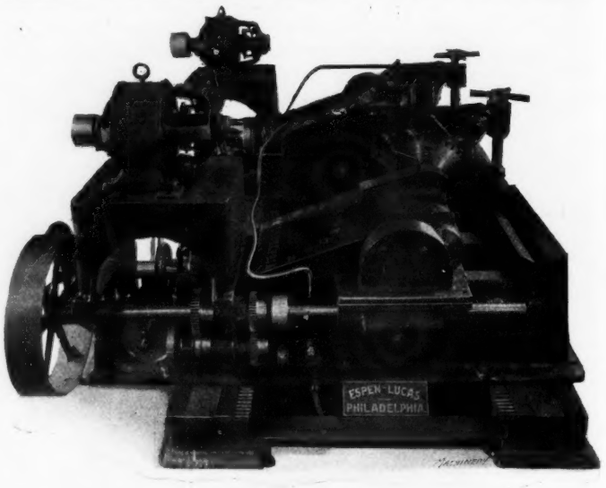
Carpenter Chart for calculating Weight of Castings from Weight of Patterns

to readers of MACHINERY are as follows: Chart No. 2, which gives areas and circumferences of circles with diameters varying by 1/16 inch, and the squares, cubes, square roots and cube roots for each 1/16 inch up to 1 foot; chart No. 3, which gives drill, drill rod, wire and machine screw sizes; and chart No. 4, which gives the sides, angles and area of right angle triangles up to 10 inches base.

ESPEN-LUCAS DUPLEX COLD SAW

The duplex cold saw illustrated herewith is a recent product of the Espen-Lucas Machine Works, Front & Girard Aves., Philadelphia, Pa. This machine is intended for cutting off both ends of axles at the same time, and for this purpose it is equipped with two 32-inch inserted tooth saw blades. The machine has a capacity for sawing off both ends of from twelve to fifteen 9-inch axles per hour. The speed and feed variations provide for sawing at an advance of 6 inches per minute. The cutting capacity is only limited by the nature of the steel that is being cut and the endurance of the high-speed steel cutters in the saw blades.

The machine is driven through a train of compound gearing, a steel worm and a bronze worm-wheel. The gearing and other parts of the machine are liberally proportioned to provide ample strength. The main bed and table are held together by heavy webs and the saw carriages have bearings of ample size on the base of the machine. The saw blades are bolted directly to the driving gears which are forged integral with the ends of the spindles. This arrangement practically eliminates the torque between the driving gear and the saw and enables the spindle bearings to extend for the entire width of the saw carriages. This drive is a strong feature of the machine. All of the gears, spindles and shafts, etc., are cut and turned from high carbon hammered steel forgings. All bearings are bushed with bronze and the thrust



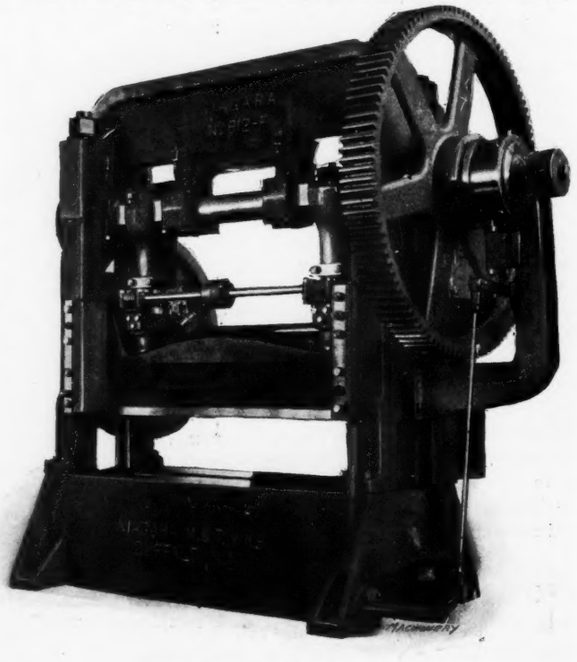
Espen-Lucas Duplex Cold Saw

of the driving worm and other revolving parts is taken up by roller thrust bearings.

The feed is variable and automatic, being controlled by an automatic stop which regulates the depth of cut up to the full capacity of the machine. The saw carriage is equipped with automatic power return and an automatic starting device which leaves the operator free to give his whole attention to the feeding of axles to the machine and removing them when finished. Pumps are provided to furnish a liberal flow of cutting compound to the saws. The machine is driven by 15-horsepower electric motors and weighs approximately 30,000 pounds.

NIAGARA DOUBLE CRANK PRESS

The large double crank press illustrated in this connection was recently built by the Niagara Machine & Tool Works,



Large Niagara Double Crank Press

Buffalo, N. Y. This machine is intended for punching and forming operations met with in steel car work, but the ma-

chine is also suitable for a wide range of heavy stamping operations. The bed, housings and arch are held together by means of four steel tie-rods 4½ inches in diameter which are a shrink fit in the parts which they connect. The same convenient method of adjusting the slide and gibs is provided that is employed on other large presses of this company's manufacture. The motion of the press is controlled by a hand lever operating a powerful jaw clutch. The working surfaces of the three jaws of the gear hub—as well as the clutch collar—are faced with hardened tool steel pieces. An automatic device is provided to stop the slide at the highest point of its stroke. Presses of this type are built in different sizes; the machine shown in the illustration measures 84 inches between the housings and has an approximate weight of 50,000 pounds.

* * *

STATUS OF THE PFAUTER PATENTS IN THE UNITED STATES

Referring to the note appearing on page 478 of February MACHINERY, engineering edition, in reference to the Pfauter patents on gear-hobbing machinery, we wish to state that this seems to have been misleading, some of our competitors assuming that they are now in a position to offer gear-hobbing machines with the differential for cutting spiral gears in the American market also. In order to correct this misunderstanding, we call attention to the fact that the United States patent which was granted to Herman R. Pfauter under date of January 2, 1900, has still about three years to run. Anyone selling or offering for sale gear-hobbing machines equipped with differential gearing for cutting spiral gears will infringe the existing Pfauter patents, and Mr. Pfauter is fully prepared to prosecute any such infringement.

New York City SCHUCHARDT & SCHUTTE

* * *

NEW MACHINERY AND TOOLS NOTES

Heating Forge: Word Brothers, San Francisco, Cal. A forge heated by oil which was particularly designed for heating rock drills; this forge is also adapted for general blacksmith work.

Roller Bearing: Royersford Foundry & Machine Co., 54 N. 5th St., Philadelphia, Pa. A new type of Sells roller bearing in which the sleeve is split and clamped over the shaft by two split collars.

Finishing Tool: Western Tool & Mfg. Co., Springfield, Ohio. A tool for finishing work in the lathe, shaper or planer which consists of a forged shank to which a steel disk which constitutes the cutter is bolted.

Drill Head: Edward Board, 619 Filbert St., Philadelphia, Pa. A four-spindle drill head designed for drilling four holes simultaneously at an angle of 45 degrees. This head is particularly designed for machining the burners of gas stoves.

Time Recorders: Baird Equipment Co., Chicago, Ill. Three types of time recorders intended for use in marking employe's weekly cards; daily job tickets; single, three or seven day job cards, or for use as a watchman's time detector.

Magnetic Chuck: O. S. Walker & Co., Worcester, Mass. A multiple pole magnetic chuck which is similar in general construction to previous types of magnetic chucks of this company's manufacture. Each pole is energized by an individual coil.

Punch and Shear: J. W. Grace Co., Burlington, Vt. A hand operated punch and shear equipped with two sets of blades. This shear will handle flat bars up to 3 by ½ inch in size. The punch has a capacity up to a ½-inch hole pierced through a ½-inch iron plate.

Facing Arm: H. B. Underwood & Co., 1024 Hamilton St., Philadelphia, Pa. A universal swiveling facing arm on which the tool-holder swivels through a complete circle and can be clamped in any position. The facing arm can be applied to either end of the bar.

Tool Racks: The New Britain Machine Co., 64 Bigelow St., New Britain, Conn. A line of steel tool racks with seamless sheet metal trays pressed from No. 16 gage steel. Racks of this type are mounted on wheels where it is desired to provide for moving them from place to place.

Circular Slide Rule: Lucien E. Picolet, 19 S. 9th St., Philadelphia, Pa. A circular type of slide rule particularly intended for performing the operations of multiplication, division and the extraction of square and cube roots. The results obtained with this rule are claimed to be as accurate as those obtained with three place logarithms.

Brazing Compound: Phillips-Laffitte Co., Philadelphia, Pa. A compound known an "Unifonte" for brazing cast iron. With this material any mechanic can braze broken cast-iron parts and produce a joint which is claimed to be stronger than the original material. "Unifonte" consists of a chemical paste which is used in connection with flux and spelter.

Pneumatic Drill: Ingersoll-Rand Co., New York City. The improved "Little David" pneumatic drill of this company's manufacture is equipped with roller bearings for the connecting rods and crankshafts which run in ball bearings. In other respects the drill is of similar design to the preceding model which has been manufactured by this company.

Cutting-off Machine: Grant Engineering Co., Detroit, Mich. A machine with a capacity for cutting stock up to 4 inches in diameter. The work remains stationary and is cut by a revolving cutter head which is worm driven. The speed of the head is automatically accelerated as the tools travel toward the center, thus maintaining a constant peripheral speed.

Thread Rolling Machine: The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn. A reciprocating machine for rolling threads on very small screws. This machine has automatic feed, and the capacity is for blanks up to an approximate diameter of 1/16 inch. The feed mechanism is so designed that short work can be handled to excellent advantage.

Belt Pole: Edward Wilbur, 125 Summer St., Boston, Mass. A belt shifting pole designed to eliminate the use of ladders in shifting belts, and at the same time to facilitate the rapidity with which shifts can be made. The pole is 9 feet long, and has a fork at the upper end, one prong of which passes under the belt while the other acts as a fulcrum on the edge of the pulley.

Boring Mill: Cincinnati Planer Co., Cincinnati, Ohio. A boring mill of lighter construction than the machines previously built by the company. The features of the present machine are centralized control, complete guarding of all dangerous parts of the mechanism, a housing of increased rigidity, and double bearings for the table pinion. Machines of this type are built in 6, 7 and 8 foot sizes.

Planer Type Surface Grinder: Newton Machine Tool Works, Inc., Philadelphia, Pa. A line of heavy surface grinders intended for grinding locomotive radius links, tongue pins, armor plate, etc. The abrasive wheel remains in a fixed position while the work held in pneumatic chucks is traversed back and forth on the table. The wheel is adjusted for the full depth of cut and full width in one operation.

High-speed Hacksaw: Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago, Ill. A high-speed hacksaw similar in design to the machine described in the June, 1911, number of MACHINERY. The present machine, however, is not provided with the cross-feed movement for advancing stock ready for a subsequent cut after a piece has been cut off. The capacity of the machine is for 6-inch square bars.

Plain Grinding Machine: Modern Tool Co., Second and State Sts., Erie, Pa. A small size grinder for manufacturing purposes. In designing this machine particular attention has been paid to features which will lessen the cost of production of work which requires grinding. The machine is known as a No. 8 size, and has the same capacity as the No. 1 universal grinding machine of this company's manufacture.

Self-opening Die: George Overton, 821 E. 167th St., New York City. A self-opening die of simple construction which has four chasers carried in blocks. In operation, the die travels over the work until the turret slide comes against its stop, when the die is opened through inertia. If preferred, an internal stop in the die shank can be set so that the end of the work will strike it and cause the die to be opened.

Two-speed Hacksaw: W. Robertson Foundry & Machine Co., Buffalo, N. Y. This company is now equipping its hacksaw machines with a two-speed mechanism designed to give suitable speeds for cutting tool and soft steels. In this way a maximum amount of service is obtained from the blades. The two speeds are obtained through a set of screws consisting of a twin gear mounted on a crankshaft which meshes with either of two pinions on the driving shaft.

Vertical Lathe: Bullard Machine Tool Co., Bridgeport, Conn. A 6-spindle vertical automatic lathe of the station type. The machine is equipped with independent work-tables, independent tool heads, cross feeds for all boring and turning cuts and a positive maximum feeding pressure for each tool head. All dangerous parts of the mechanism are adequately guarded and positive stops are provided for the tool head movements which work to 0.001 inch. A retarding mechanism is provided for indexing the spindle carrier and a controller interlocks all of the automatic movements. The

time of machining a piece on this vertical lathe is the time of the longest operation plus the time of one indexing. The weight of the machine is 16,000 pounds.

* * *

CENTRALIZED CONTROL RADIAL DRILLING MACHINE

Centralized control of machine tools has received a growing amount of attention of late years. High cutting efficiency is another equally important requirement. It has been the aim of Messrs. J. Archdale & Co., Ltd., Ledsam St., Birmingham, England, in the machine here illustrated and described, to develop these two features to the highest degree.

In the radial drilling machine illustrated in Fig. 1, centralized control has been achieved by the bold step of embodying all the speed changes in the saddle itself. The changes of speed are made by two levers operating steel sliding gears, a plate giving lever positions for the various rates of speed and feed being fixed to the saddle close to the speed change levers. It will be obvious that speed control is quicker and easier than on machines where the speed changes are made in a gear-box carried on the baseplate at the back of the column. The reversing gear is also carried on the saddle, and is operated by a convenient lever. Thus all speed changes can be made, and the spindle started, stopped or reversed without the operator changing his position. The fact that all transmission shafts and gears in this design run at a constant high speed, results in a greatly increased efficiency.

Another important feature bearing on the question of efficiency is the automatic lubrication of all gears, shafts, etc., in the saddle, which reduces the time and attention required for oiling to a minimum. Gear-driven feed motion is provided with changes made by lever, the friction clutch being operated by a lever which is always in the same position. An instantly adjustable automatic stop is provided. The spindle runs in phosphor-bronze bearings carried in a steel sleeve, is provided with a ball thrust bearing, and balanced by a compensated spring arrangement.

Naturally, the complete saddle is heavier than an ordinary saddle, but the rollers on which it is carried enable the movement along the arm to be made with the greatest ease. The traversing wheel is shown at *F*, Fig. 2, which shows a view of the saddle mechanism with the front cover removed.

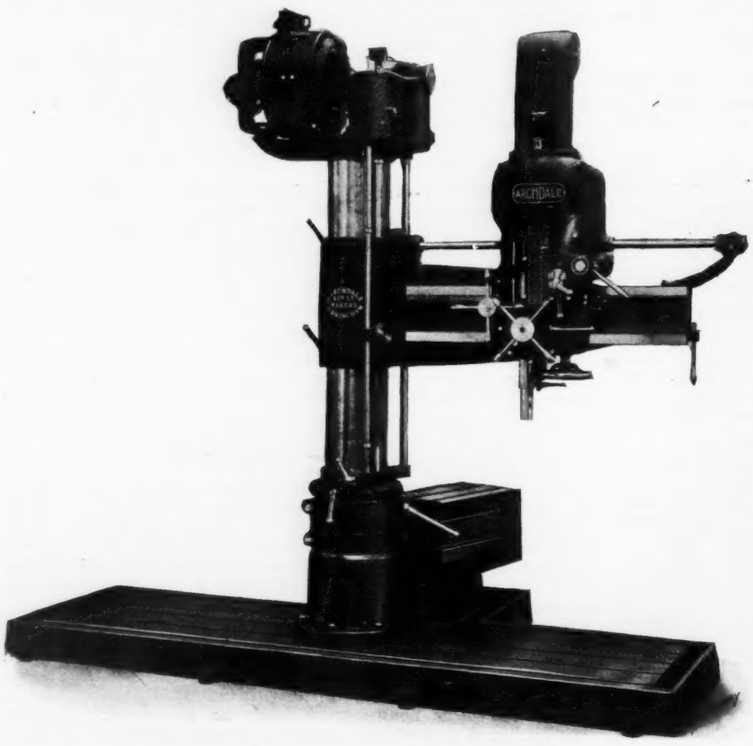


Fig. 1. Archdale Radial Drilling Machine

The mechanism for sliding the spindle gears *A* and the back gears is clearly indicated, *J* and *H* being two levers operating the sliding gears through the helical pinions *C* and racks *B*.

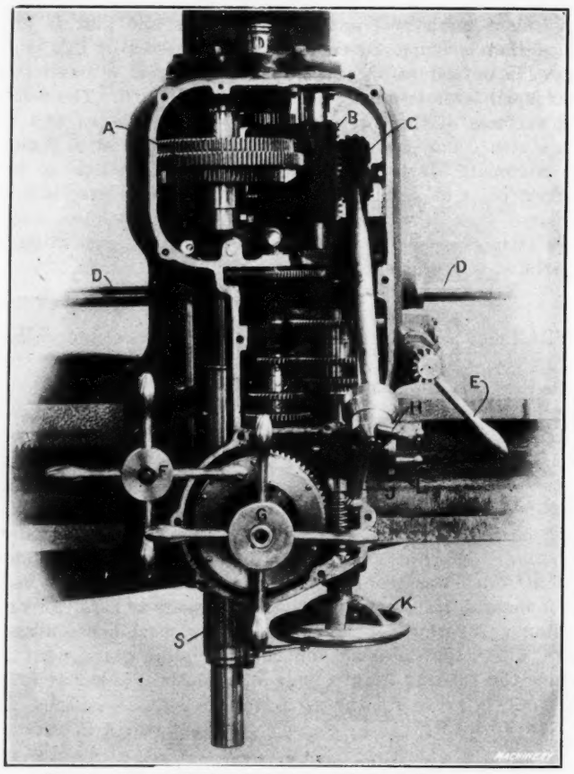


Fig. 2. View of Saddle Mechanism with Front Cover removed

The feed control is obtained at *L*. Quick and slow hand-feed motions are obtained by handwheels *G* and *K*. The reversing lever is shown at *E*.

The arm is of an oval box section, and it is claimed that this is superior to the ordinary composite section of a box with ribs top and bottom. Severe tests have shown that torsional deflection is so minute as to be practically negligible. The fixed column carries a rotating sleeve on which the arm is vertically adjustable, this sleeve being mounted on roller journal bearings and a ball thrust bearing, making the swinging of the arm extremely easy. A convenient lever is provided for rigidly clamping it to the fixed column. A friction gear-box at the top of the sleeve operated by a convenient handle controls the vertical movement of the arm, safety stops being provided to prevent over-running.

The base is double-ended and has an extension at the back. Thus, as drilling proceeds on one portion, work may be set up at either one or both of the two remaining positions. The operator, therefore, can be drilling practically the whole of the time, moving from one position to another. As setting up of work on drilling machines takes up a considerable portion of the whole time, it is clear that this is a valuable feature where a large output is required. The box table may be used in either of three positions or swung clear of the base. The motor, which rotates with the arm and sleeve, is at the top of the column, and therefore can never be an obstruction to work being set up on the baseplate. Where the work is such as requires lubricating, the pipe is taken up through the center of the column, fitted with swivel joint, and connected by flexible pipe to the saddle. The lubricant is thus available for all positions of the spindle or arm with-

out danger of fouling the pipe. The pump is, in this case, a separate unit, being connected to the machine by pipes, preferably under ground, in covered troughs.

* * *

AIR BRAKE TESTS, PENNSYLVANIA RAILROAD

Important improvements in the braking of heavy passenger cars were described in a paper read before the American Society of Mechanical Engineers at the Engineering Building, New York City, February 10, by S. W. Dudley of Pittsburg. Air brake tests were conducted jointly by the Pennsylvania R. R. and the Westinghouse Air Brake Co., and the results are considered the most important recent contribution to the subject. A train of twelve steel cars running at sixty miles per hour stores up 224,000,000 foot-pounds of energy. This is sufficient to raise the entire train 120 feet. With prevailing brake equipment such a train would be stopped by an emergency application in a distance of 1600 to 2200 feet, according to the truck rigging and brake shoe design. These tests showed that this distance has actually been reduced to 1000 feet or to within the length of the train. This was the result of improvements in the truck brake design involving the clasp brake, having two shoes per wheel, and the location of the brake shoes with reference to the horizontal center line of the wheels, in addition to improved methods of applying the air brakes quickly and simultaneously and at a high pressure. This concerns safety. These tests emphasized, as has never been done before, the possibilities of improvement in efficiency and economy in regular service operation by proper attention to design and installation in order to permit the realization of the flexibility of improved air brake apparatus. These improvements center in the electric control of the brakes, giving quick, simultaneous and responsive action. The electric control has opened the way for maximum effect in practice of improvements in practically all the factors involved in air brake apparatus, all of which were covered in the development represented by these tests. The tests constituted a progressive development of brake rigging and brake shoes in connection with the scientific study of the air brake as a whole. Fifteen years ago trains were stopped in about half the distances prevailing in the practice of today. Increased size and weight of equipment brought an entirely new brake problem. These tests showed that high-speed braking on the longest passenger trains can be accomplished with safety but at the expense of a somewhat complicated apparatus which responds to both pneumatic and electric impulses.

* * *

CLEVELAND AUTOMATIC FOR MACHINING BRASS NUTS

The Cleveland Automatic Machine Co., Cleveland, Ohio, recently installed two of its ⅞ to 1¼ inch model C "automatics" in the plant of the Metric Metal Works, Erie, Pa. These two machines are equipped with an air chucking device, a rotary tilting magazine, and special tools to adapt them for facing and tapping brass coupling nuts ranging from a very small size up to 2½ inches in diameter. The machines have now been in operation long enough to show that they are exceptionally well adapted for nut work. The output is three times that which has ever been obtained by any other method.

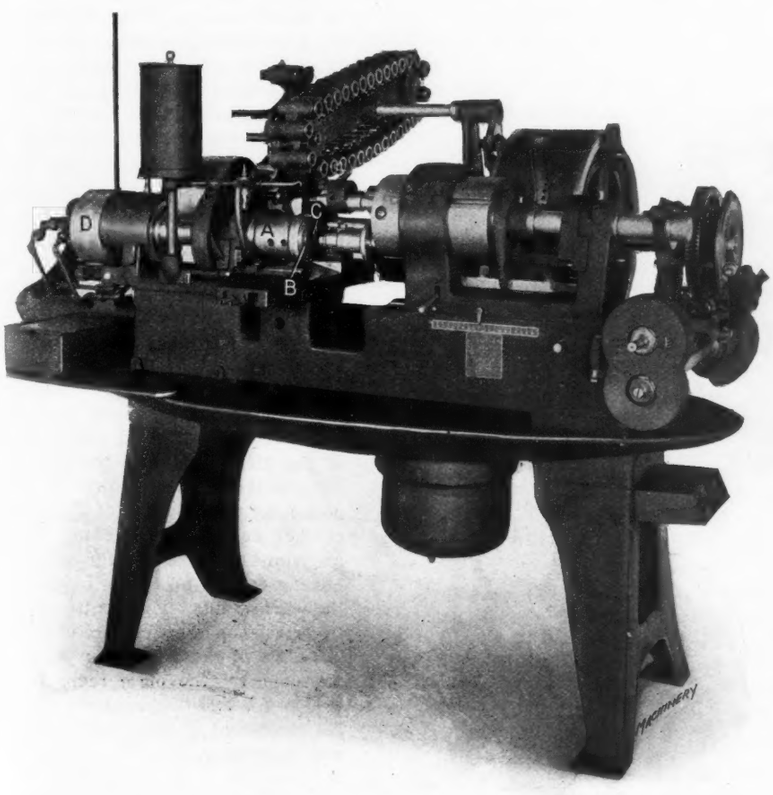


Fig. 1. Front View of Cleveland Automatic for machining Brass Nuts

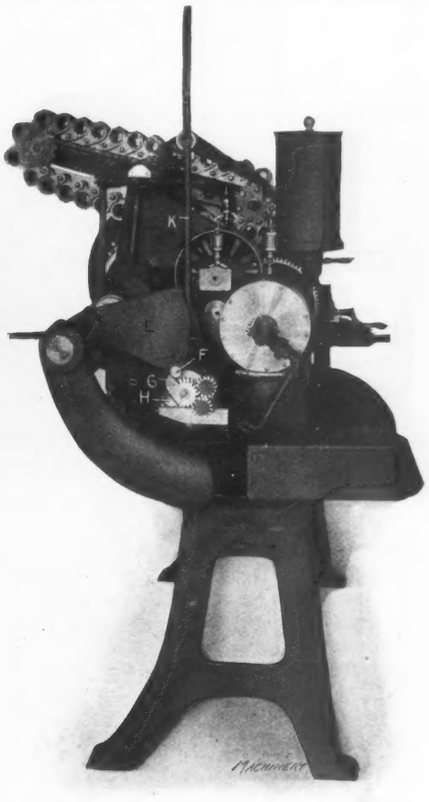


Fig. 2. End View of Machine showing Mechanism for controlling Air Chuck

The air chuck on the machine in Fig. 1 is shown at *A*. The chuck is screwed onto the spindle in place of the regular chuck hood and is fitted with three removable jaws *B* which, in turn, are provided with three pads *C* that can be shaped to suit various kinds of work. The rear end of the spindle is shortened and the air cylinder *D* is screwed onto it. A connecting-rod actuated by the piston in the cylinder *D* operates the chuck jaws *B*, the admission of air at each side of the piston opening and closing the chuck.

Fig. 2 shows an end view of the machine where the mechanism for controlling the admission of air to the cylinder *D* is clearly illustrated. The segment *E* is fitted with a roller *F* in contact with the lever *G* that operates the air valve to release the chuck. The geared lever *H* swings up as the lever *G* is carried down by the roller *F;* a second roller on the opposite side of the segment *E* then comes into contact with the lever *H* as the segment swings around and this moves the valve to its original position, closing the chuck and

at the same time exhausting the air on the opposite side of the piston. The air supply pipe *K* is fitted with a sight-feed lubricator (not shown) which thoroughly oils the piston and moving parts of the air valve.

The rotary tilting magazine *L*, Fig. 3, is equipped with a link belt *M*, each link being fitted with a bushing of suitable shape to hold the work. When the magazine *L* tilts up after the conveyor *N* has removed a blank, the lever *P* comes in contact with the pin *R* which indexes the link belt to bring another piece of work in line with the conveyor when the magazine swings down the next time. This rotary tilting magazine was described in detail in the February number of MACHINERY, so that further discussion of this feature of the machines which form the subject of the present article is unnecessary.

The conveyor *N* is fitted with a flanged sleeve *S* that comes in contact with a stop on the turret head (not shown) on the backward stroke of the turret after the chucking operation. Should the chuck fail to grip the work, the sleeve *S* strips the work off the conveyor, thus allowing the conveyor to remove another piece of work from the magazine without

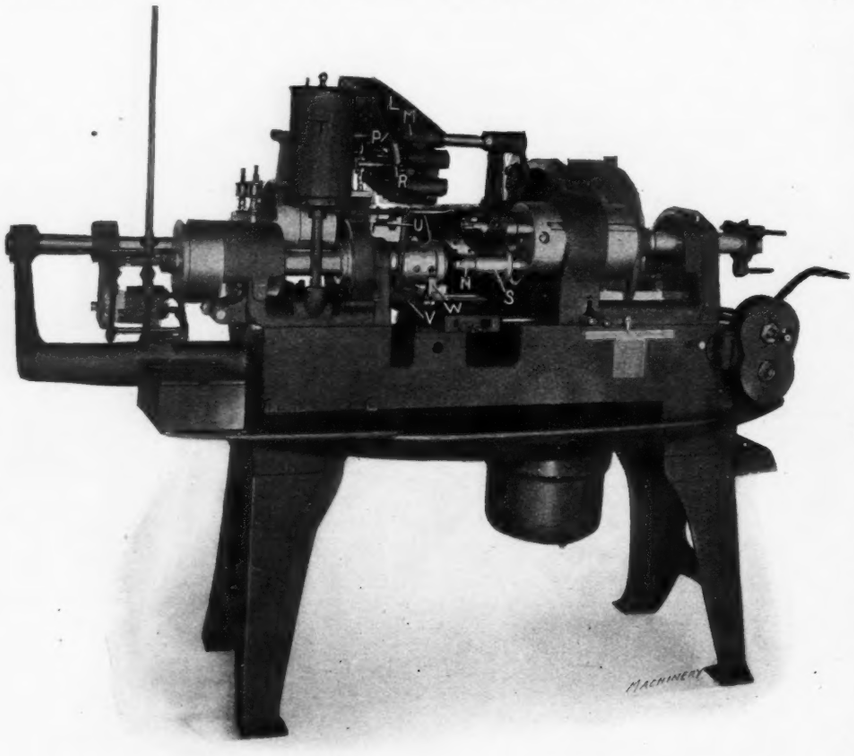


Fig. 3. Arrangement of the Magazine and Chuck Mechanisms

interference. If the finished work is not ejected from the chuck, the forward movement of the next blank carried by the conveyor comes in contact with it and compresses a spring in the shank of the conveyor *N;* this takes up the strain and avoids damaging the machine.

Fig. 3 also shows an oiling device used to drop oil onto the tap. This lubricating equipment consists of the tank *T* with suitable piping and a valve *U* which is operated by a lever *V* pivoted on the spindle head and operated by the tripping dog *W* on the cross-slide. As the cross-slide moves forward to allow the facing tool on the rear of the slide to operate, the tripping dog *W* strikes a V-block on the lever *V*, causing the valve *U* to open and drop the required amount of oil onto the tap. The amount of oil supplied may be varied from one drop to a steady stream, being under control of the operator.

It has already been stated that these machines were built to meet the special requirements of the Metric Metal Works, but "Cleveland" automatics equipped with this type of air chuck can be used for all sorts of work requiring drilling, counterboring, reaming, tapping, recessing and similar operations.

ADMINISTRATION BUILDING OF NEW DEPARTURE MFG. CO.

The New Departure Mfg. Co., Bristol, Conn., recently moved into its new Administration building, which has been in course of construction for the last twelve months. The demand for New Departure ball bearings has increased so rapidly that the company could not wait to build the required additions to its manufacturing plant, and as a result bought the factory of the Whitlock Coil Pipe Co., Hartford, Conn., which comprises 145,000 square feet of floor space. The office quarters were also inadequate and this deficiency has been met by the erection of the new Administration building, which is 62 feet wide by 220 feet long and six stories high. The building is modern in every detail of construction and is absolutely fireproof. The outer walls are of light grey brick in three shades, relieved by broad ribbons of blue and green colored tiles at the second and fifth stories. The entrance is reached by a broad flight of granite steps, and is flanked on each side by hand-carved limestone panels.

The ceiling of the main vestible of the building is decorated in Roman gold, and the side walls are panelled with marble. The floor is also of marble with a geometrical design worked out in tiles, and with the monogram of the company in green and white as a center piece. The main lobby, which is just beyond the vestibule, is 16 feet square; the floor is of Italian marble and the wainscot is relieved by ornamental capitals. The office is located on the fifth floor of the building and is reached by an electric elevator which runs from the lobby.

The private offices of the officials and heads of departments are located at the front and south side of the fifth floor. The workers in each department are directly opposite the private office of the head of that department. These offices are finished with panels of mahogany carried up to the height of the window sills. The partitions between the general offices are of plate glass above the wainscot. At the west side of the office there is a double fire- and burglar-proof vault. All equipment of this vault is steel and absolutely fire-proof. One of the features of the main office is a large leaded glass dome ceiling light 112 feet in length by 16 feet wide. In addition to the general offices there is a large foremen's conference room on this floor, which has a small kitchen attached to provide for serving luncheons.

On January 1 the following changes were made in the organization of the New Departure Mfg. Co.: Mr. Albert F. Rockwell, who was one of the founders of the company and who has taken an active part in the development of patents covering the product, has been relieved of certain managerial details, but continues as president of the company. Mr. DeWitt Page, who formerly held the positions of secretary, sales manager, purchasing agent and advertising manager, has been appointed general manager of the company. Mr. Charles T. Treadway, for some years past treasurer of the company, continues in that capacity, but also becomes chairman of the board of directors.

* * *

Tax factories and there will be fewer factories; tax trade and there will be less trade; tax machinery and there will be less machinery; but tax the value of land and of natural resources and there will not be any less land or natural resources.

A ROTARY CUTTING-OFF MACHINE

A machine which has accomplished some remarkable performances in cutting off bars and tubes has recently been built by Charles Taylor, Ltd., Birmingham, England. The cutter revolves around the bar or tube to be cut off, the work being held stationary in a vise. This avoids revolving long and heavy bar stock, and facilitates moving up and regripping the work. The cutters do not have to be stopped while the rod is being adjusted, thus reducing to a minimum the time lost in cutting off several pieces in succession.

The headstock consists of a substantial iron casting forming the main body of the machine and having massive split bearings in which runs a hollow spindle carrying the cutter-head. The cutter-head has two cutter-slides operated by a hand lever, which feeds the cutters in by means of chains passing through the spindle. These chains act in connection with an automatic balancing device to insure the cutters doing equal work. Fig. 1 shows how this is accomplished. In this illustration *A* is the cutter, *B* the slide carrying the cutter, *C* the chain which feeds the cutter in, and *D* a yoke which can oscillate on a cylindrical bearing in the piece *E*. Thus as one cutter is forced out, the yoke *D* moves on its bearing and draws the opposite cutter in until both cuts are exactly equal, and they remain so throughout the cut.

In most cutting-off machines it is highly important for both cutters to be set precisely alike to a gage, and this requires a skilled operator. In the machine under consideration, this is not of great consequence because if the cutters *A* are carelessly placed, even to the extent of 1/16 inch or more, as indicated by the dotted lines on the end of the cutters, the effect when the machine is at work is that one cutter retreats and the other advances until both cutters are working precisely alike. When this balance is obtained the cutters remain in position until they are again taken out for resharpening. An unskilled operator can handle this balancing machine.

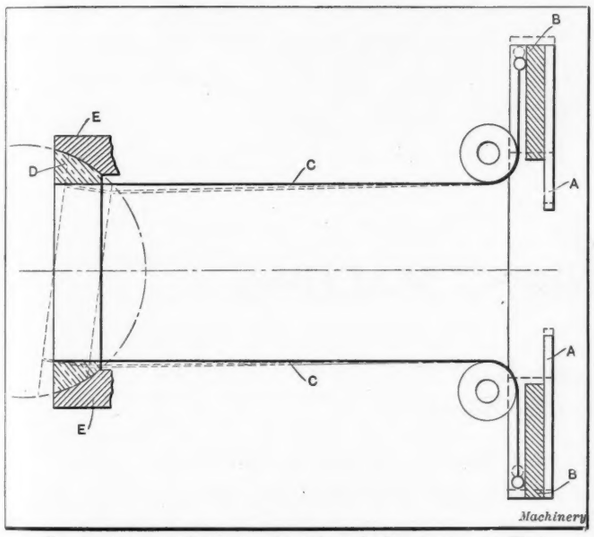


Fig. 1. Diagram illustrating Method of feeding Cutters to Work

The feed chains are protected by a steel liner running the whole length of the spindle, the spindle being driven by a balanced cast-iron pulley of 16 inches diameter, for a three-inch belt. The cutters are of plain oblong section and are rigidly supported throughout their length. As shown in Fig. 2, they are so placed as to have ample clearance at all points and require grinding on one face only. This is accomplished by having their bearings so shaped that when the cutters are clamped in place they lie in such a position that only the extreme corner of one side of each is in contact with the work, except, of course, the front cutting edge. All other parts have a liberal clearance. Moreover, the cutters are offset from each other so that each takes a cut of less width than the groove which is being cut. This allows the chips to swell, as all chips do, without binding in the groove. Also when the cutters are dull they simply yield slightly from the face of the groove and so touch without the slightest binding effect. As the cutters are of plain rectangular section set to cut their own clearance, they cannot wear narrow on the front or cutting edge and bind in the groove, which is a frequent and continuous trouble with the ordinary formed cutting-off tool. In Fig. 3, for instance, showing the usual formed tool, the points *A* and *B* break off causing the tool to bind in the groove on the sides *C* and *D* with consequent breakage.

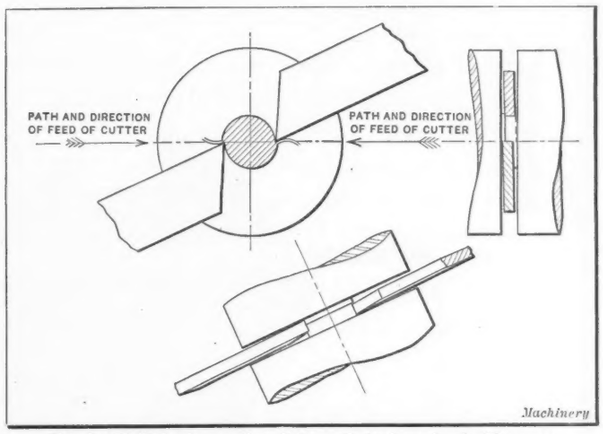


Fig. 2. Method of mounting Cutters that gives Ample Clearance

Other features of the machine include a lever stop with a spring plunger set to act in such a way that the spring is compressed as the stock is cut through, thus serving to retard the advance of the cutters at the last moment and to insure that the end of the stock is left clean. The stock is held in a self-centering vise in front of the cutters, and provision is made to support the stock which projects from the vise by means of an adjustable roller support, which facilitates the feeding of heavy stock through the vise. The cut off pieces are supported in the spindle on a long supporting member projecting into the spindle from the rear end. A two- or three-speed countershaft is provided enabling the speed to be changed, if necessary, while cutting is actually in progress.

The performance of this machine can be gaged as follows. The average time for cutting off solid bars is, for ¾-inch round mild steel, 11 seconds; 1-inch round mild steel, 12 seconds; 1½-inch square mild steel, 19 seconds; 2-inch round mild steel, 22 seconds; 3-inch round mild steel, 45 seconds; and 2-inch round cast steel, 65 seconds. In dealing with gas pipe, a 1½-inch pipe can be cut off in 5 seconds. J.

* * *

DELICACY OF THE CHEMICAL BALANCE

Those not familiar with the methods of chemical analysis have very little conception of the delicacy of the chemical balance and extreme care that must be taken when ascertaining weights to a fraction of a milligram. The balance is supported by the knife-edges only when actual weighing is in progress. When the substance to be weighed is being placed on the pan, and during all manipulations of the weighing, the rule is to raise the beam off the knife-edges by means provided for the purpose. When not in use the beam is always supported by the auxiliary means provided. Extreme care must be taken to keep the knife-edges free from corrosion. A jar of unslacked lime or pure sulphuric acid is kept in the case to absorb atmospheric moisture. A warm object cannot be accurately weighed because the air currents set up a disturbing force sufficient to vitiate the accuracy of the work.

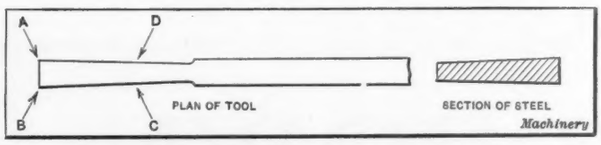
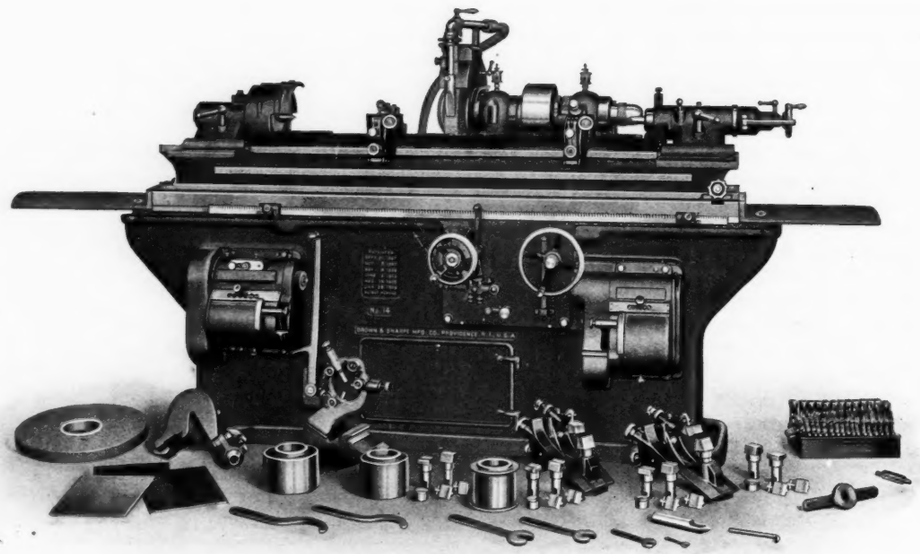


Fig. 3. Diagram illustrating Weakness of Formed Cutter

Grinding Time on This Work is



No. 14 PLAIN GRINDING MACHINE

You are probably familiar with some, if not all of the various types of machine parts represented in the case opposite.

It is the sort of work to be found in quantity in many manufacturing shops—work on which a small saving per piece means a worth while saving by the end of the day.

There are long, slender shafts requiring careful support, pieces of large diameter on which heavy cuts are taken, taper bearings on spindles, irregular shaped work as shown near top of case, etc.

We have developed the type of Plain Grinding Machine with quick change work speeds and table traverse, shown above, as particularly fitted for rapid production on such work.

BROWN & SHARPE

PROVIDENCE, R. I.,

OFFICES: 20 Vesey St., New York, N. Y.; 654 The Bourse, Philadelphia, Pa.; 626-630 Washington Blvd., Chicago, Ill.; 305 Chamber of Commerce Bldg., Rochester, N. Y.; Room 429 University Block, Syracuse, N. Y. REPRESENTATIVES: Baird Machinery Co., Pittsburgh, Pa., Erie, Pa.; Carey Machinery & Supply Co., Baltimore, Md.; E. A. Kinsey Co., Cincinnati, Ohio, Indianapolis, Ind.; Pacific Tool & Supply Co., San Francisco, Cal.; Strong, Carlisle & Hammond Co., Cleveland, O., Detroit, Mich.; Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; Perine Machinery Co., Seattle, Wash.; Portland Machinery Co., Portland, Ore. CANADIAN: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Winnipeg, Calgary, Vancouver, St. Johns, Saskatoon. FOREIGN: Buck & Hickman, Ltd., London, Birmingham, Manchester, Sheffield, Glasgow. F. G. Kretschmer & Co., Frankfurt, a/M., Germany. V. Lowener, Copenhagen, Denmark; Stockholm, Sweden; Christiania, Norway. Schuchardt & Schutte, St. Petersburg, Russia. Fenwick Freres & Co., Paris, France; Liege, Belgium; Turin, Italy; Zurich, Switzerland; Barcelona, Spain. The F. W. Horne Co., Tokio, Japan. L. A. Vail, Melbourne, Australia. F. L. Strong, Manila, P. I.

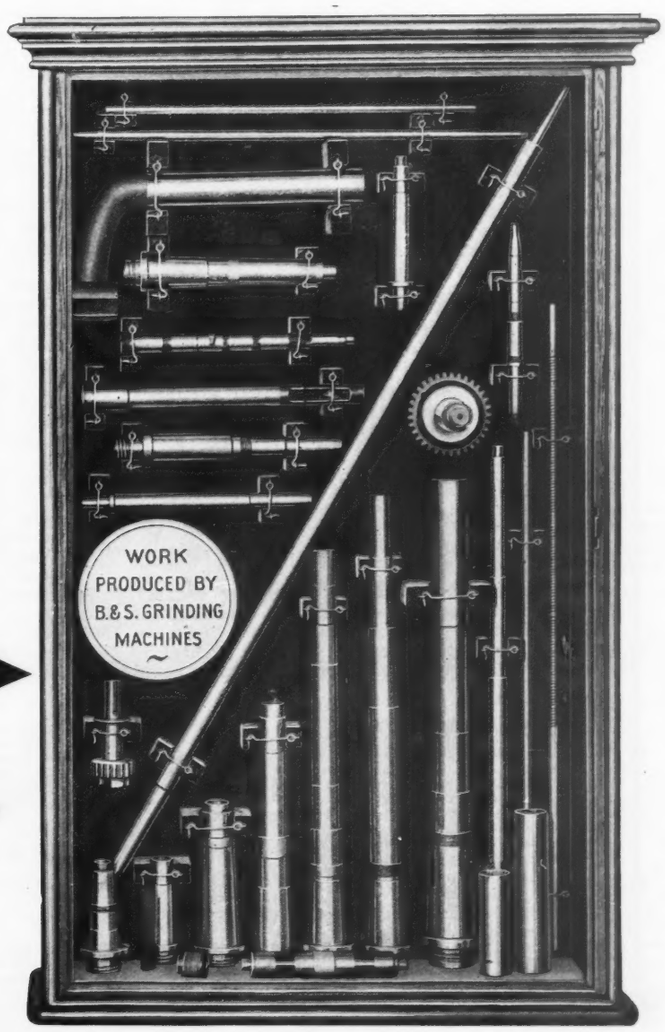
Reduced By Our New Machine

When the foreman of the grinding department distributes work similar to that shown in the case, he often gives advice as to the approximate rate of work speed and table traverse to be used. But it lies with the operators to try these suggestions and change about, if necessary, until the combination best suited to each particular job is obtained. A slight change in speed or traverse of the work means a considerable difference in the finish, as well as the rate of production.

We have made it handy for the operators to change speeds and feeds, consequently they will adjust the combinations to get the fastest production consistent with the required finish.

The speed and feed changing mechanisms are both self-contained in the machine—no complicated overhead works. Changes are instantly made by adjustment of index slide and levers. The two change gear boxes are located right beside the operator. He can change from a roughing to a finishing feed by the movement of one lever. Ask us about some of the other rapid production features.

The Combination Plain and Universal Back Rests furnish a support which allows rapid grinding on all varieties of work. For long, slender shafts, either with or without keyway, they are used as full universal rests, following up the work as it is reduced in diameter. By substituting a solid, adjustable shoe beneath the work, they are made semi-universal, for use on heavy work. For the very heavy grinding, both spring actuated shoes are changed to solid adjustable ones, making them Plain Back Rests.



MFG. CO.

U. S. A.

Read Page 67

PERSONALS

Henry Pollard recently took charge as superintendent of manufacturing of the Chicago plant of the Benjamin Electric Co.

E. E. Hendee, secretary of Joseph T. Ryerson & Son, returned to Chicago in the middle of February after a two weeks' trip to the South and Southwest.

Edward Blake, who for several years was sales manager of Wells Bros. Co., Greenfield, Mass., and for the past three years general manager of the J. T. Slocomb Co., Providence, R. I., has resigned his position with the company. Mr. Blake has made no definite plans for the future.

A. B. Hall, for the past fourteen years connected with the machinists' supply department of the Whitman & Barnes Mfg. Co., was elected a director and second vice-president of the company at the annual stockholders' meeting held January 28 at the general offices, Akron, Ohio.

William Miller has discontinued his connection as secretary of the firm of Henry Disston & Sons, of Philadelphia, after a service of thirty-seven years, and on February 1 associated himself with the Simonds Mfg. Co., Fitchburg, Mass., and Chicago, Ill. Mr. Miller is one of the most experienced and efficient men in the saw, knife and file-making business, and is well and favorably known in the hardware trade.

O. P. Wilson, of the purchasing department of the Westinghouse Electric & Mfg. Co., has resigned to take the position of assistant general manager of the Norma Company of America, 20-24 Vesey St., New York City, manufacturer and importer of high-grade ball bearings, precision instruments, etc. Mr. Wilson has been connected with the Westinghouse Electric & Mfg. Co. for fourteen years, and for the last ten years has been one of its head buyers.

C. S. Dundore, after thirteen years' service as treasurer and general manager of the American Die & Tool Co., Reading, Pa., has started in business for himself under the name of the Dundore Mfg. Co., 221 S. 9th St., Reading, Pa. The company will serve the tool and contract work trade, being equipped to make tools and dies and also to do contract work in the manufacture of machines and metal specialties. Special attention will be given to the manufacture of boiler and bridge builders' tools.

* * *

OBITUARIES

Neil W. Snow, president and general manager of the Detroit Twist Drill Co., Detroit, Mich., died January 22, aged thirty-four years.

William Colthar, proprietor and general manager of the Victor Vise Co., Springfield, Ohio, and a manufacturing machinist, died January 19, aged forty-nine years. Mr. Colthar acquired his mechanical training with the Mechanics Institute at Cincinnati, and after considerable experience in the machine tool industry in the latter city he undertook work on his own account, being the original designer of the Timken roller bearing. He did considerable work on the Paige typesetting machine, and designed many original machines. He is survived by his widow and one son.

Caleb Colvin, founder of the Caleb Colvin iron foundry, which later became the L. W. Pond Machine & Foundry Co., Worcester, Mass., died of bronchitis at his home in Worcester, February 17, aged eighty-five years. He was born in Cranston, R. I., and at the age of eighteen was apprenticed to the iron molder's trade. He went to Worcester in 1865 and established the iron foundry business, which was afterward made a partnership known as C. & J. A. Colvin. The business was incorporated in 1887 under the name of the L. W. Pond Machine & Foundry Co. Mr. Colvin retired from active business in 1905.

Erwin Starr Sperry, editor and publisher of the *Brass World and Platers' Guide*, died at Bridgeport, Saturday, January 31. Mr. Sperry was born in Ansonia, Conn., in 1866, and graduated from the Sheffield Scientific School of Yale University in 1887, where he afterward held a position as assistant instructor in chemistry under Prof. H. L. Wells. In 1891, he went to Bridgeport as chemist for the Aluminum Brass & Bronze Co., and afterward became superintendent of the Waldo Foundry. Ten years ago, he started publishing the *Brass World and Platers' Guide*. He was a member of leading scientific societies of this country and Europe. Mr. Sperry is survived by his widow.

David B. Hyde, one of the Hyde brothers who have been closely connected with the emery wheel manufacturing business since its inception, died February 14 at Riverside, Cal., of pneumonia, aged fifty-five years. He was born at Wilmington, Vt., in 1859 and at the age of thirteen was thrown upon his own resources. He and one of his brothers (mere boys at the time) showed great enterprise by placing on the market a patent inkstand, and thousands of these stands were sold in America and Europe. Mr. Hyde was one of the pioneers in the manufacture of emery wheels and grinding machinery. In 1880 he, with his four brothers and D. T. Homan, started the Springfield Glue & Emery Wheel Co. at Springfield, Mass., being the first to make emery wheels for water tool grinding in this country. In 1893 he and his brother, O. H. Hyde, and E. C. Gwynn, organized and started the Safety Emery Wheel Co. of Springfield, Ohio, and he introduced the safety collars used on emery wheels. Mr. Hyde also originated the "Champion" tool-holder now manufactured by the Western Tool & Mfg. Co. of Springfield, Ohio. He was later connected with the Pittsburg Emery Wheel Co., but on account of poor health sold out his business interests and went to California, where he was engaged in dry farming on an extensive scale at the time of his death. Mr. Hyde leaves a widow, two daughters and one son; also three brothers, E. R. Hyde of the Bridgeport Safety Emery Wheel Co. and O. H. and C. L. Hyde of the Safety Emery Wheel Co. of Springfield, Ohio.

Henry Brinton, president of the H. Brinton Co., Philadelphia, Pa., died at his home at Bala, January 30, after a brief illness with heart trouble, aged sixty-six years. He was born at Christiana, Lancaster Co., Pa., of a line of Quaker ancestry descended from William Brinton who came to America in 1684. He received a thorough training as a machinist in the shops of I. Broomell & Sons, now the Christiana Machine Co., and later spent about two and one-half years with Bement-Miles & Co., Philadelphia. From there he went to the Colt's Armory in Hartford, Conn., where he worked for a time on the Baxter engine. His next work was on the Branson knitting machine at Bellefonte, Pa. When the Branson Co. failed, Mr. Brinton went to the Lancaster Watch Co. at Lancaster, Pa., where he obtained experience in fine manufacturing methods which had a pronounced effect on his own designing later. When the Branson Co. was reorganized, Mr. Brinton went back to Bellefonte, only to meet another financial crisis. After a further experience at the Lancaster Watch Co., he joined Branson a third time in Philadelphia and was for some years the superintendent of the knitting machinery business under the Branson name. In 1888 Mr. Brinton started manufacturing knitting machines in the partnership of Brinton, Denney & Co., and five years later, Mr. Denney sold his interests to J. E. Longergan and the firm name became H. Brinton & Co. The business was incorporated in 1906 under the name H. Brinton Co. Mr. Brinton probably did more to improve and commercialize automatic cylinder knitting machines of the latch needle type than anyone else. He took out patents on the knitting machine sinker mechanism with the sinker driven from below the stitch level. On ribbers, the Brinton design was revolutionary. The ribber pattern wheel mechanism built by Mr. Brinton twenty years ago, has not been surpassed or changed to this date. Splicing devices for inserting an extra thread is also of Brinton design and a ring in the dial cap for operating multiple-feed rib machines was another Brinton invention. In general, it may be said that the prime feature of Mr. Brinton's work was the beautiful simplicity of his mechanism for producing complex results. When he finally adopted a design, that design was usually as near to the perfection of mechanical simplicity as it was possible for it to be made. He was married in 1874 to Rachael Cawley, who with a daughter and two sons survive him.

COMING EVENTS

April 4-11.—First National Efficiency Exposition and Conference, Grand Central Palace, New York City. Walter H. Tallis, director, Efficiency Society, Inc., 41 Park Row, New York City.

April 29-30.—Annual meeting of the National Association of Cotton Manufacturers, Boston, Mass., in the Paul Revere Hall of the Mechanics Bldg. C. J. H. Woodbury, secretary, 45 Milk St., Boston, Mass.

May 1-October 31.—Anglo-American Exposition, London, England, to celebrate the centenary of peace between the United States and Great Britain. American executive offices: Woolworth Bldg., New York City. Charles J. Kiralfy and Albert E. Kiralfy, commissioners general.

June 15-17.—Annual convention of the American Supply & Machinery Manufacturers' Association at White Sulphur Springs, West Virginia; New Green Brier Hotel, headquarters. General offices of the association, Woolworth Bldg., New York City.

September 20-25 (1915).—International Engineering Congress, San Francisco, Cal., in connection with the Panama-Pacific International Exposition. W. F. Durand, chairman, Foxcroft Bldg., San Francisco, Cal.

NEW BOOKS AND PAMPHLETS

Copper Wire Tables. 69 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Circular 31 of the Bureau of Standards.

Standard Specifications for Incandescent Electric Lamps. 20 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Circular 13 of the Bureau of Standards.

United States Coast and Geodetic Survey. Annual Report of the Superintendent to the Secretary of Commerce. 100 pages, 6 by 9 inches. Published by the Department of Commerce, Washington, D. C.

High-frequency Ammeters. By J. H. Dellinger. 70 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Reprint No. 206 from the Bulletin of the Bureau of Standards, Vol. 10.

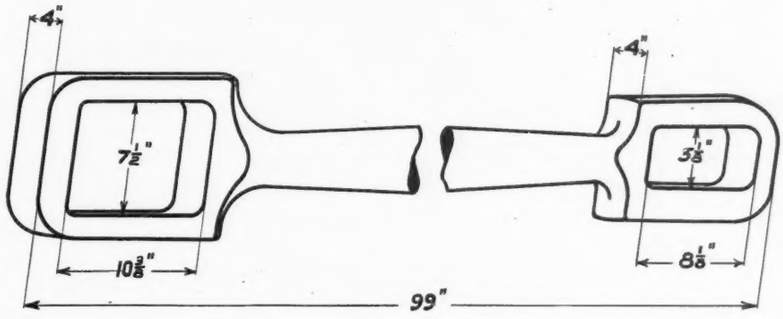
Electrolytic Corrosion of Iron in Soils. By Burton McCollum and K. H. Logan. 69 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as No. 25 of the Technologic Papers of the Bureau of Standards.

Latent Heat of Fusion of Ice. By H. C. Dickinson, D. R. Harper and N. S. Osborne. 32 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as No. 209 of the Scientific Papers of the Bureau of Standards.

General Practice is

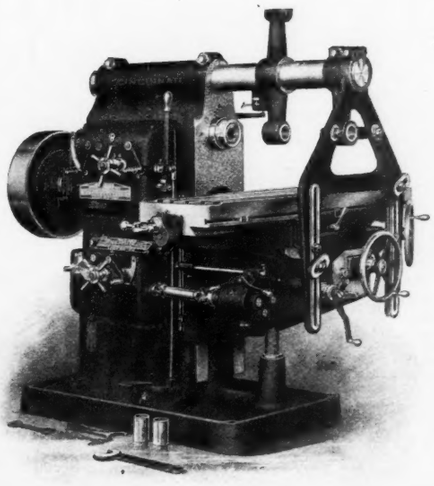
to drill and slot the holes for brasses in closed end connecting rods

We think milling would pay you



One of our customers mills the above rod complete in 160 minutes on a Cincinnati No. 5 High Power Miller.

A starting hole is drilled in each end. Then the rectangular opening is cut out at one setting with a special cutter, the chips being washed away by our copious oiling arrangement. A roughing and a finishing cut are taken. The resulting surfaces are flat, smooth and accurate to .002″ in every direction.



Wouldn't similar results in your own shop interest you?

Send our Time Study Department a blue-print of one of your rods. Let them submit recommendations and an estimate of the time required. It will be profitable and interesting.

The Cincinnati Milling Machine Co.

Cincinnati, Ohio, U. S. A.

EUROPEAN AGENTS: Alfred H. Schutte, Cologne, Berlin, Brussels, Milan, Paris, Barcelona, St. Petersburg. Donauwerk Ernst Krause & Co., Vienna, Budapest and Prague. Sam Lagerlofs, Stockholm, Sweden. Chas. Churchill & Co., Ltd., London, Birmingham. Manchester, Newcastle-on-Tyne and Glasgow.

CANADIAN AGENTS: H. W. Petrie, Ltd., Toronto, Montreal. Taylor & Young, Vancouver.

AUSTRALIAN AGENTS: McPherson's Pty., Ltd., Melbourne. **JAPAN AGENTS:** Andrews & George, Yokohama.

CUBAN AGENTS: Krajewski-Pesant Co., Havana. **ARGENTINE AGENTS:** Robert Pusterla & Co., Buenos Aires.

Coal Washing in Illinois. By F. C. Lincoln. 108 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 69. Price 50 cents.

A great amount of data gathered from experiments made in the mining laboratory of the university, personal visits to the various coal washeries in the state and a thorough search of the scattered literature on the subject has been compiled and tabulated in this bulletin. The bulletin also contains an article by S. W. Parr on the moisture in washed coals and is a summary of tests made at the Experiment Station on carload lots of various washed coals.

Elementary Manual of the Steam Engine. By Ernest V. Lallier. 266 pages, 5 by 7¾ inches. 102 illustrations. Published by D. Van Nostrand Co., New York City. Price $2.

This work, as indicated by the title, is intended for the instruction of students and young men studying the elements of engineering. It treats of reciprocating steam engines, governors, engine calculations, the indicator, heat, boilers, pumps, Corliss engines, pipes and fittings, rotary engines, internal combustion engines and lubrication. Wherever possible, principles are illustrated with arithmetical examples, and questions are given at the end of chapters which may be used for self-examination to the student studying at home. The work is one that should be appreciated by the class generally for whom it is intended.

Factory Organization and Administration. By Hugo Diemer. 378 pages, 6 by 9 inches. 172 illustrations. Published by the McGraw-Hill Book Co., Inc., New York City. Price $3.

The first edition of this work was published in 1910. In rewriting the book, the author has rearranged the material in what appears to be more logical order. The subjects treated comprise: Principles, Field and Methods of Industrial Management; Industrial Finance; Organization and Control; Typical Factory Organizations; Factory Accounts; Departmental Reports; Factory Location; The Planning of Factory Buildings and the Influence of Design on Their Productive Capacity; Employment of Labor and Labor Problems; General Office; Order Department; Bills of Material; Drafting Department; Pattern Department; Purchasing Department; Stores and Stock Department; The Production or Planning Department; Foundry Systems; The Machine Shop and Tool Department; Shipping and Receiving Departments; Time Taking; Cost Department; Aids in Taking Inventory; Inspection Methods in Modern Machine Shops; Rate Fixing and Time Studies; Wage Systems; Principles Underlying Good Management; and A Bibliography of Works Management.

Welding—Theory, Practice, Apparatus and Tests. By Richard N. Hart. 210 pages, 6 by 9 inches. 127 illustrations. Published by the McGraw-Hill Book Co., Inc., New York City. Price $2.50

The first edition of this work was published in 1910. The rapid progress of the last three years in apparatus and methods of welding has made a revision necessary, especially with regard to arc welding and oxy-acetylene welding. The work deals with the characteristics of iron, platinum, gold, silver, aluminum, copper, and nickel. The electric welding processes are described, including the La Grange-Hobo process, the Zerener electric blowpipe, the Bernardos arc-welding process, the Slavianoff arc-welding process, combination Slavianoff and Bernardos processes, and the Thomson process. Part III is devoted to hot-flame welding, treating of the oxy-acetylene and oxy-hydrogen processes. The torches and apparatus in general are illustrated and described. A chapter is devoted to the thermit process, illustrating its apparatus and application to rail welding, marine repairs and other characteristic jobs for which it is especially suited. A chapter is given up to soldering and miscellaneous processes including the Lafitte welding plate, the "ferrofix" brazing process, brazing and soldering, the Blaugas process, etc. The work is one to be recommended to all desiring to become acquainted with the characteristics of the various welding processes developed within the past few years. While the treatment of the subjects is by no means exhaustive, it leaves comparatively little to be desired by those who wish to gain a general knowledge of the modern welding art.

NEW CATALOGUES AND CIRCULARS

Massachusetts Institute of Technology, Boston, Mass. Catalogue for 1913-1914.

Stevens Institute of Technology, Hoboken, N. J. Annual catalogue 1914-1915.

Technical Supply Co., Scranton, Pa. Booklet describing the Levi automatic blueprint finisher.

Polytechnic Institute, Brooklyn, N. Y. Annual catalogue of the College of Engineering, 1914-1915.

Alston Saw & Steel Co., Folcroft, Pa. Circular of the Alston process improved hacksaw blades made for all purposes.

Laidlaw-Dunn-Gordon Co., Cincinnati, Ohio. Bulletin 22 on air compressor efficiency and the factors controlling it, with special reference to the Cincinnati air gear.

Brown Hoisting Machinery Co., Cleveland, Ohio. Pamphlet C on "Brownhoist" safety crabs and winches. Provision is made so that the handles cannot fly back and the load cannot drop.

Hannifin Mfg. Co., Chicago, Ill. Circular illustrating and describing Hannifin air-operated chucks, including master hinge air-operated collet chucks, and two- and three-jaw universal chucks.

H. A. Lowe, 1374 E. 88th St., Cleveland, Ohio. Circular of the Lowe universal test indicator weighing 1¼ ounce and magnifying 100 times. The dial is graduated to thousandths inch.

Northern Engineering Works, Detroit, Mich. Crane catalogue 26 illustrating electric traveling cranes, hand power traveling cranes, electric and pneumatic hoists, overhead track systems, bucket handling cranes and railway cranes.

Railway Roller Bearing Co., Syracuse, N. Y. Catalogue of the roller journal boxes, electric motor bearings, etc. The construction of the bearing is shown and examples of applications to electric locomotives, street cars, motors, etc., are included.

Simplex Wire & Cable Co., 201 Devonshire St., Boston, Mass. The "Simplex" manual containing, in addition to information regarding "Simplex" products, tables and data for the ready reference of electrical engineers, contractors, wiremen, etc.

Greenfield Machine Co., Greenfield, Mass. Catalogue No. 5 of the "Greenfield" universal tool and cutter grinder and its attachments. The uses of the attachments are illustrated and other matter is contained of value to users of tool grinding machines.

Mesta Machine Co., Pittsburg, Pa. Bulletin M of the Mesta improved pickling machines for pickling metal objects of any shape. The Mesta machine brings mechanical action into play to such an extent that the material is pickled with about one-half of the acid and labor required in hand pickling.

Webster & Perks Tool Co., Springfield, Ohio. Circulars of Nos. ¾ floor or bench type grinder, 1¼ "T" self-oiling grinding and polishing machine, 1¾, 1½ and 1⅝ direct-current electrically driven floor type polishing and buffing lathes, and 1¾ alternating-current direct-connected electrically driven type grinder.

Gould & Eberhardt, Newark, N. J. Catalogue of high-duty shapers and attachments, details of construction and general specifications. The line comprises 14-inch, 16-inch, 20-inch, 24-inch and 28-inch sizes. Shapers with direct-current and alternating-current motor drives are shown, and accessories for same.

Winfield Electric Welding Machine Co., Warren, Ohio. Catalogue of Winfield electric welding machines, comprising spot and butt welding machines, which are illustrated and described. The catalogue contains information on electric welding useful to manufacturers employing the electric welding process.

Royersford Foundry & Machine Co., 54 N. 5th St., Philadelphia, Pa. Catalogue "Saving the Friction Loss—'Sells' Roller Bearings," containing a description of the construction, operation and application of "Sells" roller bearings. The catalogue is illustrated with halftone and sectional views, the latter showing the design in detail.

Wood Turret Machine Co., Brazil, Ind. Catalogue of the "tilted turret" lathe, a feature of which is that the turret is so made and placed that the stock can pass clear through, thus giving unlimited capacity in length of work. The machine is made in six sizes, ranging from 1 inch to 4½ inches automatic chuck capacity.

National Lead Co., 111 Broadway, New York City. Pamphlet on electro-plating zinc alloy die-castings, giving practical methods for cleaning, polishing and electro-plating the various alloys used in die-casting. The information contained will be particularly acceptable to electro-platers who have experienced difficulty in doing this class of work.

Pawling & Harnischfeger Co., Milwaukee, Wis. Pamphlet entitled "Difficult Drilling and Boring Made Easy," illustrating work done by the Pawling & Harnischfeger drill presses in machine shops. Manufacturers having to drill large structural work, castings, etc., should find the illustrations and descriptions of these drilling machines of interest.

National Tube Co., Pittsburg, Pa. Bulletin No. 18-A entitled "National Reamed and Drifted Pipe." This bulletin contains a complete description with illustrations of this product, together with a short introduction explaining the processes of well drilling and information relative to the various accessories necessary for the drilling and pumping of wells.

Cutler-Hammer Mfg. Co., Milwaukee, Wis. Pamphlet on door safety switches for use with electric elevators. A great majority of accidents on all kinds of elevators are the result of setting the elevator machine in motion before the doors are closed and locked and the passengers clear. With the ever-increasing number of passengers the safety feature is of the utmost importance.

National Tube Co., Frick Bldg., Pittsburg, Pa. Bulletin 19, listing the products of the company. An idea of the extent of the products manufactured can be gained from the fact that the bulletin has eight pages, two columns to the page, filled with small type. Of "Kewanee" products, 852 are listed; of "National" pipe products, sixty-four, and of Shelby seamless steel tubing products, thirty-seven.

Niles-Bement-Pond Co., 111 Broadway, New York City. Catalogue of Niles electric traveling cranes, showing the equipment of Niles standard traveling cranes and details of construction. Grab bucket trolleys, electric wall cranes, gantry cranes, traveling hoists and hand power frames are also shown. The catalogue is beautifully illustrated with numerous views of works in which Niles bridge traveling cranes are installed.

Curtis Pneumatic Machinery Co., 1568 Kienlen Ave., St. Louis, Mo. Catalogue of air compressors, air hoists, air cranes, pneumatic and hydro-pneumatic elevators, trolleys, trolley systems and sand blasts. The company has specialized in pneumatic hoisting appliances for over twenty years and has developed the simple air cylinder into a straight-line motor with wonderful speed control and dependability, capable of the widest application to hoisting problems.

Gardner Governor Co., Quincy, Ill. Circular "The Gardner One Tool Plant," consisting of a vertical self-oiling air cooled compressor, 2 by 2½ inches, driven by ½ H. P. electric motor, mounted on a four-wheel truck. A tool-box is provided and a rack for hose. The machinery is enclosed in a removable cover and the outfit forms a compact, portable compressed air plant. While primarily designed for stoneworkers, monumental work, etc., it should serve in many other situations where compressed air is required.

Yale & Towne Mfg. Co., 9 East 40th St., New York City. Pamphlet entitled, "History of the Trade-mark 'Yale,'" which is a record of cases in which the company's rights have been sustained and confirmed in litigation involving a legal right in trademarks, catalogue numbers, distinctive designs and other indications of the origin of patterns. The pamphlet is one that should be read with interest by all concerned with trademarks, and it should also be found interesting by readers in general because of the matter contained on the origin of locks.

Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Rail Reports Bulletin No. 4 on open hearth steel. This bulletin contains a summary of chemical and physical results as reported in bulletins 1, 2, 3 and 4 on standard open hearth A rails and titanium open hearth treated A rails. It was found that the average hardness of standard rails is twenty-four per cent greater in the webs than in the heads and flanges while in the titanium treated rails, the average difference is only five per cent. The impact resistance of titanium rails averaged thirty-five per cent higher than of standard rails in the heads, four per cent in the webs and fifty per cent in the flanges. Titanium rails in the White-Souther endurance test averaged fifty per cent greater endurance than standard rails. The value of these reports on extensive rail tests is evident to all metallurgists and users of rails.

H. W. Caldwell & Son Co., Western Ave., 17th to 18th Sts., Chicago, Ill. Catalogue No. 38 on elevating, conveying, power transmitting and general machinery, containing 797 pages, 6 by 9 inches. The company makes helicoid conveyors, machine molded gears, friction clutches, ice handling machinery, specialties for flour mills, grain elevators, cotton seed oil mills, alfalfa plants, starch works, linseed oil mills, breweries, distilleries, malt houses, sugar refineries, glucose works, cement works, phosphate works, lime works, gypsum works, chemical works, tanneries, etc. The catalogue is one of the most complete in the line of power transmission elevating and conveying machinery. It is copiously illustrated, printed on high-grade paper and completely indexed. It should be in the hands of every engineer and manufacturer having use for the line of machinery and parts listed.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Catalogue of LeBlond engine lathes which are furnished in various styles, with such combinations of equipment as may be desired, as follows: regular stud lathe, 14 to 20 inches swing; regular standard engine lathe, 12 to 24 inches swing; regular quick-change engine lathe, 12 to 24 inches swing; heavy-duty manufacturers' automobile lathe, 17 to 21 inches swing; seventeen-inch rapid production lathe; heavy-duty standard engine lathe, 25 to 33 inches swing; heavy-duty quick change engine lathe, 17 to 33 inches swing; heavy-duty quick change engine lathe, 25 to 33 inches swing; heavy-duty quick change sliding bed gap lathe, 19-38, 25-50 and 30-60 inches swing; regular plain chucking lathe, 12 to 24 inches swing; heavy-duty quick change combination turret lathe, 17 to 27 inches swing; heavy-duty manufacturers' complete turret lathe, 24 to 27 inches swing—with triple gear single pulley drive, 31 inches swing; heavy-duty quick change universal turret lathe, 17 to 33 inches swing; motor-driven engine lathes of any size or type. A line of accessories is shown comprising turrets, turret toolposts, compound rests, relieving attachment, multiple automatic length stop, belt shifter, draw-in attachment and collets, translating gears for metric threads, etc.

TRADE NOTES

Warren Forge & Tool Co., Warren, Ohio, has elected James Robertson, president; M. J. Konold, vice-president and secretary; George E. Warner, treasurer; and George F. Konold, general manager.

Walcott & Wood Machine Tool Co., Jackson, Mich., has bought the patent rights, patterns and good-will of the Melling-Northrup die-sinking machine manufactured by the Melling-Northrup Co., Jackson, Mich.

Gem City Machine Co., 429 East First St., Dayton, Ohio, was destroyed by fire during the last week in January. Three days later, however, the firm was operating in other quarters, delivering orders and contracting for new work.

Buffalo Forge Co., Buffalo, N. Y., has opened offices at 176 Federal St., Boston, Mass., for its fan, ventilating and pump department. The company is represented in the New England territory by B. R. Andrews, formerly with the B. F. Sturtevant Co.

J. T. Slocomb Co., Providence, R. I., maker of machinists' micrometers, centering drills, etc., has been sold to J. H. Drury, sales manager of the Union Twist Drill Co., Athol, Mass. J. T. Slocomb, who organized the business, will remain for a short time.

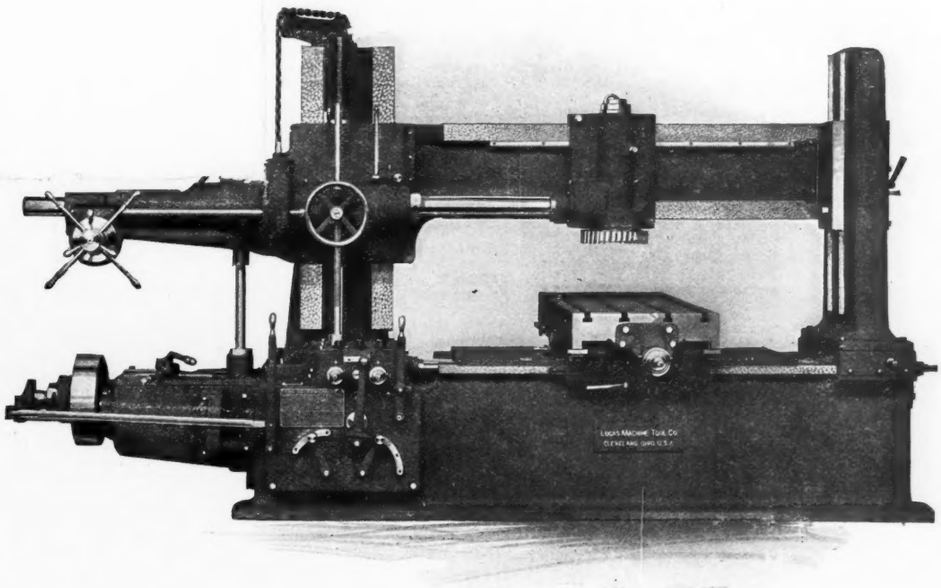
Eveland Engineering & Mfg. Co., 2324-2328 Market St., Philadelphia, Pa., has been authorized by its

"The way to keep the little things out is to fill one's mind with the big things."

In designing the

"PRECISION"
BORING, DRILLING AND MILLING
MACHINE

we strive for the BIG THING of a HARMONIOUS WHOLE rather than the little "talking points."



The user can't sell talking points, he must sell the PRODUCT OF THE MACHINE.

The "PRECISION" PRODUCES and KEEPS RIGHT ON PRODUCING.

Lucas Machine Tool Co., NOW AND ALWAYS OF **Cleveland, Ohio, U.S.A.**

AGENTS: C. W. Burton, Griffiths & Co., London. Alfred H. Schutte, Cologne, Berlin, Brussels, Paris, Milan, St. Petersburg, Barcelona, Bilbao. Donauwerk Ernst Krause & Co., Vienna. Budapest, Prague. Overall, McCray, Ltd., Sydney, Australia. Andrews & George, Yokohama, Japan. Williams & Wilson, Montreal, Canada. H. W. Petrie, Ltd., Toronto, Ont.

into the sixth enlarged edition. Forty-two pages have been added, the additional matter including a table of prime factors from 10,000 to 100,000 and a new table giving the chordal thickness of gear teeth and the distance from the chord to the top of the tooth. The tables for bevel gears giving the diameter increment, the apex distance to the pitch line, angles of edge and angles of face have been extended. Additions have also been made to the tables giving the number of cutters for use in cutting bevel gears. The subject is dealt with essentially from the draftsman's standpoint and covers the principles of spur gearing, spur gearing formulas, bevel gearing, worms and worm-wheels, spiral gearing, internal gearing, bevel gear cutters, indexing, gearing of lathes for screw cutting, tooth parts, solution of triangles, trigonometrical tables, angles for gashing worm-wheels, and the subjects before mentioned.

The Resistance of Guns. By Leone Coupaye and Pietro Malaval. 262 pages, 7 by 10 inches. Illustrated. Edited by Carlo Pasta, Piazza Castello, 22 Turin, Italy.

Captain Hector Bravetta of the Italian Royal Navy, well known to students of naval matters on account of the many articles contributed to technical reviews in Italy and abroad, has translated and united in one volume three important memoirs on the resistance of guns which engineers Leone Coupaye and Pietro Malaval of the French Naval Artillery had published in French. Mr. Coupaye points out that it is absolutely impossible to build guns having purely elastic deformations greater than the elastic limit of the metal of which the internal tube is made, and that the limit is about nine-tenths of the elastic limit. This is true whatever system of manufacture be adopted, and applies to both built-up and wire-wound guns. The elastic limit of a gun is very limited. If the metal forming the internal tube, for instance, possesses an elastic limit of 40 kilograms, a gun of normal thickness will become permanently deformed under a pressure of 3600 kilograms per square centimeter. The work is published in Italian.

Scientific American Reference Book of 1914. By Albert A. Hopkins and A. Russell Bond. 597 pages, 5½ by 7½ inches. 1000 illustrations. Published by Munn & Co. Inc., New York City.

This comprehensive reference book is indispensable to the business man as it will answer all sorts of questions that may come up in the course of affairs. The work is divided into two sections, Part I containing statistical information and Part II scientific information. Under statistical information are statistics on population and social relations; farms, foods and forests; mines and quarries; manufacture; commerce; mercantile marine; railroads; the Panama Canal; telegraphs and cables; wireless telegraphy; telephone statistics of the world; post office affairs; patents, trade-marks and copyrights; armies of the world; navies of the world; aviation. In Part II on scientific information are chapters on chemistry; astronomy and time; meteorology; machine elements and mechanical movements; geometrical constructions; weights and measures. The division of the matter into parts and chapters and the index make for easy reference to any matter treated.

Working Drawings of Machinery. By Walter H. James and Malcolm C. Mackenzie. 143 pages, 6 by 9 inches. 220 illustrations, 21 folding plates. Published by John Wiley & Sons, Inc., New York City. Price $2 net.

The authors are, respectively, assistant professor of mechanical engineering and instructor in mechanical engineering of the Massachusetts Institute of Technology, and the book was written to meet the needs of the second and third year students studying drawing in the Institute. The aim has been to give correct conception of the character and purpose of a working drawing and to suggest the relation between a pictorial drawing of an object and its orthographic projection. The plan was also to illustrate good, modern drafting-room practice. The contents comprise discussion of general principles, conventional representations, dimensioning and describing, sketching, scale detail drawing, general drawing, design drawings, diagrammatic drawings, mechanical pictorial drawings, etc. The book should be found generally useful to draftsmen. The appendix contains a number of tables of machine details, such as bolt heads and nuts, cap screws, machine screws, standard threads, Acme threads, washers, cotter pins, taper pins, tapers, keys, etc.

NEW CATALOGUES AND CIRCULARS

James Anderson & Sons, Sidney, Ohio. Circular of the "Conus" oil cups for all purposes.

Standard Tool Co., Cleveland, Ohio. Catalogue No. 21 of drill chucks and circular of the "Shield" brand high speed drills.

American Can Co., 104 So. Michigan Ave., Chicago, Ill. Catalogue of sheet metal presses, wire working machinery and die shop equipment.

Richard W. Jefferis Co., Camden, N. J. Folder of Jefferis pressed steel lockers, wardrobes and shelving for offices, shops and factories.

Fosdick Machine Tool Co., Cincinnati, Ohio. Circular illustrating and describing new style No. 0 horizontal boring, drilling and milling machine.

W. W. Blakely, 100 Leicester Court, Detroit, Mich. Circular of the "Common Sense" adjustable boring tool for use on lathes, boring machines and drilling machines.

Billings & Spencer Co., Hartford, Conn. Circular describing the Billings & Spencer No. 0 double-acting ratchet which is provided with two removable sockets for taper and square shank drills.

Brown Hoisting Machinery Co., Cleveland, Ohio. Catalogue E of Brown hoists, grab buckets, slag buckets, contractor's grab buckets, shovel buckets and various kinds of tubs.

Millers Falls Co., Millers Falls, Mass. Circulars of automatic boring tool No. 45, "Star" hacksaw frame No. 14½ and "Star" hacksaw frame No. 1011 having pistol grip.

Walden Mfg. Co., Worcester, Mass. Circular of "Walden-Worcester" wrenches comprising ratchet wrenches, combination sets for automobiles, offset wrenches, tee-handle wrenches, etc.

Hess-Bright Mfg. Co., Front St. and Erie Ave., Philadelphia, Pa. Booklet on ball bearings, for axle lighting generators, showing details of railway car equipment for generating electricity used for lighting cars.

Index Visible, Inc., Times Bldg., New York City. Circular of a visible card index system, the cards being mounted on vertical aluminum strips so that the key word of each card is visible.

G. L. Simonds & Co., 115 S. La Salle St., Chicago, Ill. Booklet entitled "Economical Steam Production" showing the use of the "Vulcan" soot cleaner and data on economies effected.

Crescent Tool Co., Jamestown, N. Y. Circular of "Crescent" universal pliers which hold securely taper, half round, triangular, and other shapes as well as rectangular, parallel and round pieces.

F. E. Wells & Son Co., Greenfield, Mass. Card illustrating the Wells improved Stillson pattern pipe wrench in which the wooden handle is provided with double ferrules to prevent breaking.

H. W. Johns-Manville Co., 41st St., & Madison Ave., New York City. Specifications of J-M asbestos roofing and waterproofing material for shops, factories, mills, office buildings and other structures.

Morrison Boiler Co., Sharon, Pa. Circular of the Morrison water tube boiler illustrated with views of a 200 H. P. boiler recently erected for the National Pulp & Turpentine Co., Green Cove Springs, Florida.

Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill. Bulletin No. 34-D on Chicago pneumatic Corliss compressors, steam driven, containing description of construction and mechanical details with illustrations.

Gilbert & Barker Mfg. Co., Springfield, Mass. Pamphlet on the Gilbert & Barker process for burning fuel oil under low pressure, with illustrations of apparatus and installations in large manufacturing plants.

Fox Machine Co., Grand Rapids, Mich. Sectional catalogues on hand and power feed milling machines Nos. 2, 3 and 3½; universal trimmers; bench, floor and column types, and mitering machines; tube and pipe cutting machines Nos. 1, 3, 5 and 6; adjustable dado heads.

E. L. Patten, St. Louis, Mo. Postcard illustrating and describing the "Universal" bench filing machine having adjustable work table and adjustable file carrier enabling the user to file all angles in either direction up to 5 degrees.

Flexible Steel Lacing Co., 544 W. Jackson Blvd., Chicago, Ill. Circular of "Alligator" steel lacing for machinery belting, consisting of steel hooks that can be applied with a hammer only. The hooks form a flexible joint when joined with a sectional rocker hinge pin.

Firth-Sterling Steel Co., E. S. Jackman & Co., agents, 710-714 Lake St., Chicago, Ill. Catalogue of Firth-Sterling steels, including treatise on tool steel, the selection of steel, and heat-treatment of all grades. The catalogue contains valuable information for all steel users.

Graham Mfg. Co., 94 Point St., Providence, R. I. Pamphlet entitled "The Virtues of a Vise" illustrating uses of the Graham drill vise for drilling machines, milling machines, shapers or planers. The jig vise may be used as a substitute for expensive jigs on many kinds of work.

Kasenit Co., 21 State St., New York City. Circular of "Kasenit" open-fire casehardening compound which is said to be the most rapid compound for open fire hardening. It is non-poisonous, non-explosive and non-inflammable, and may be used for casehardening and carbonizing wrought iron, mild steel and tool steel.

C. H. Driver & Kerr Co., 1300 Sixteenth St., Racine, Wis. Circular of the Driver & Kerr drill racks for use in machine shops. These racks are ingeniously devised so as to prevent the drilling machine man from putting his drills into the wrong holes. Hence, the rack is a time saver, as every drill must be in its proper place.

Cincinnati Milling Machine Co., Cincinnati, Ohio. Circular of "Cincinnati" semi-automatic milling machines with intermittent feed and power quick return, 28-inch size. The circular illustrates the machine including details of construction. This is essentially a manufacturing machine, applicable to the work found in armories, sewing machine factories, etc.

Cowan Truck Co., Holyoke, Mass. Catalogue on the Cowan transveyor illustrated with views showing use in printing plants, automobile factories, electric welding shops, screw machine departments, electric manufacturing works, paper mills, etc. The catalogue gives conclusive evidence of the value of the truck or transveyor in reducing cost of handling materials in industrial plants of all kinds.

R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. Pamphlet on the LeBlond belt shifting attachment for lathes, milling machines and other machine tools. This mechanically operated attachment shifts the drive belt of cone-driven machines quickly and in either direction. It not only eliminates the danger incident to changing belts, but converts an ordinary cone-driven headstock into a quick speed change mechanism.

Hannifin Mfg. Co., Chicago, Ill. Catalogue of "Aero" devices comprising air-operated chucks, countershafts, mandrels, clamping fixtures, vises, gate valve seating chucks and other air-operated tools and machinery. The use of compressed air for quick machine tool operation, especially in brass working lathes has assumed large proportions in the last few years. The catalogue is of considerable interest to all mechanics.

J. S. Bretz Co., 250 West 54th St., New York City. Booklet on F. & S. annular ball bearings (made in Germany) of the single annular type fitted with ribbon ball separator and the W. H. narrow width ball separators. The company is the sole importer of these bearings, and the booklet lists each bearing, giving the outside diameter, bore, width, ball diameter, number of balls, load in pounds, etc. The dimensions are given in millimeters and a table of inch equivalents is included.

Wells Bros. Co., Greenfield, Mass. Catalogue of gages, comprising standard cylindrical or ring and plug gages, plug and templet thread gages, screw pitch gages, pipe thread gages in sets, fork cylindrical limit gages, fork thread limit gages, "Crescent" thread limit gages, screw thread micrometers. The catalogue contains interesting and useful matter on standards of length, the use of measuring tools, how to hold screw thread micrometers and data on screw threads. It should be in the hands of every progressive mechanic.

American Swiss File & Tool Co., 24 John St., New York City. Catalogue and revised price-list of American Swiss files. A price revision was made necessary by the new tariff law, under which hand cut files and files of precision are dutiable at 25 per cent ad valorem. The company has revised its prices to meet the competition as far as possible, but states that the new prices cannot be lowered without lowering the standard of quality. Excepting a few shapes and cuts below 6 inches in length, all files will be found as low in price as any of approximately equal quality made abroad. The catalogue is of interest to all toolmakers and other users of fine files.

Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Bulletin No. 3, "Rail Reports on Open Hearth Steel" containing a summary of the results of chemical and physical tests on seven standard and seven titanium-treated open hearth A rails. The work being done by the company in making comparative tests of standard and titanium-treated steel rails and publishing results of same is attracting wide attention from metallurgists and users of rails. The bulletin is profusely illustrated, showing large sulphur prints and sections of A rails and micro-photographs taken from the top of head, center of head, web, center of flange, bottom of flange and end of flange.

TRADE NOTES

Worcester Lathe Co., 134 Gold St., Worcester, Mass., is the designation under which C. E. Thwing is marketing a new eleven-inch lathe built for him by the Whitcomb-Blaisdell Machine Tool Co.

W. H. Leland & Co., Worcester, Mass., manufacturers of sensitive drilling machines, have changed the firm name to "Leland-Gifford Co.," the members of the firm remaining the same as before.

N. C. Walpole, Southern representative of the Niles-Bement-Pond Co. and the Pratt & Whitney Co., has opened a sales office and a machinery display room at 2015 First Ave., Birmingham, Ala.

J. Faessler Mfg. Co., Moberly, Mo., manufacturer of boiler tools, has removed its general sales office to rooms 1934-6 Railway Exchange Bldg., St. Louis, Mo. Charles F. Palmer remains in charge.

DeForrest Electric Welding Co., Cleveland, Ohio, has been incorporated to do an electric welding business. The following are interested: H. J. Lamb, M. M. McLaughlin, C. F. Miser, H. B. Altman and Edward Cherney.

Hoefer Mfg. Co., Freeport, Ill., has appointed the J. R. Stone Tool & Supply Co., Detroit, Mich., which has opened a Chicago branch office at 820 Ashland Block, as agent for the Hoefer auxiliary heads in Chicago territory.

James Maher Chain Tongs & Wrench Mfg. Co., of East Liverpool, Ohio has been incorporated with a capital of $25,000. James Maher, Michael Maher, Thomas Terry, H. E. Pfaff, L. L. Campbell and George Wurzell are interested.

Galion Iron Works & Mfg. Co., Galion, Ohio, has been incorporated with a capital of $10,000 to manufacture machinery and tools. W. Pelton, B. T. Meyer, C. C. Gilmore, C. D. Wise, D. G. Strother, O. P. Beck and D. C. Boyd are incorporators.

Rockford Drilling Machine Co., Rockford, Ill. S. H. Reck, secretary and treasurer has sold his interest to William Nelson, president who now becomes the sole owner of the business of manufacturing upright drills, gang drills and lathes.

Kelly Reamer Co., Cleveland, Ohio, has increased its capital stock from $25,000 to $50,000 common stock. The increase of capital stock was made to enable the company to increase its facilities and to care for the rapidly growing business in Kelly reamers, etc.

Baxter-Frick Gear Cutting & Mfg. Co., Cleveland, Ohio, has been incorporated with a capital of $25,000 to manufacture and sell gears. The following parties are interested: Archie K. Baxter, William H. Frick, Vincent A. Taylor, Oswald M. Hoch and Mrs. Grace Dartos.